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ELECTRICAL WORLD

MARCH 15, 1930

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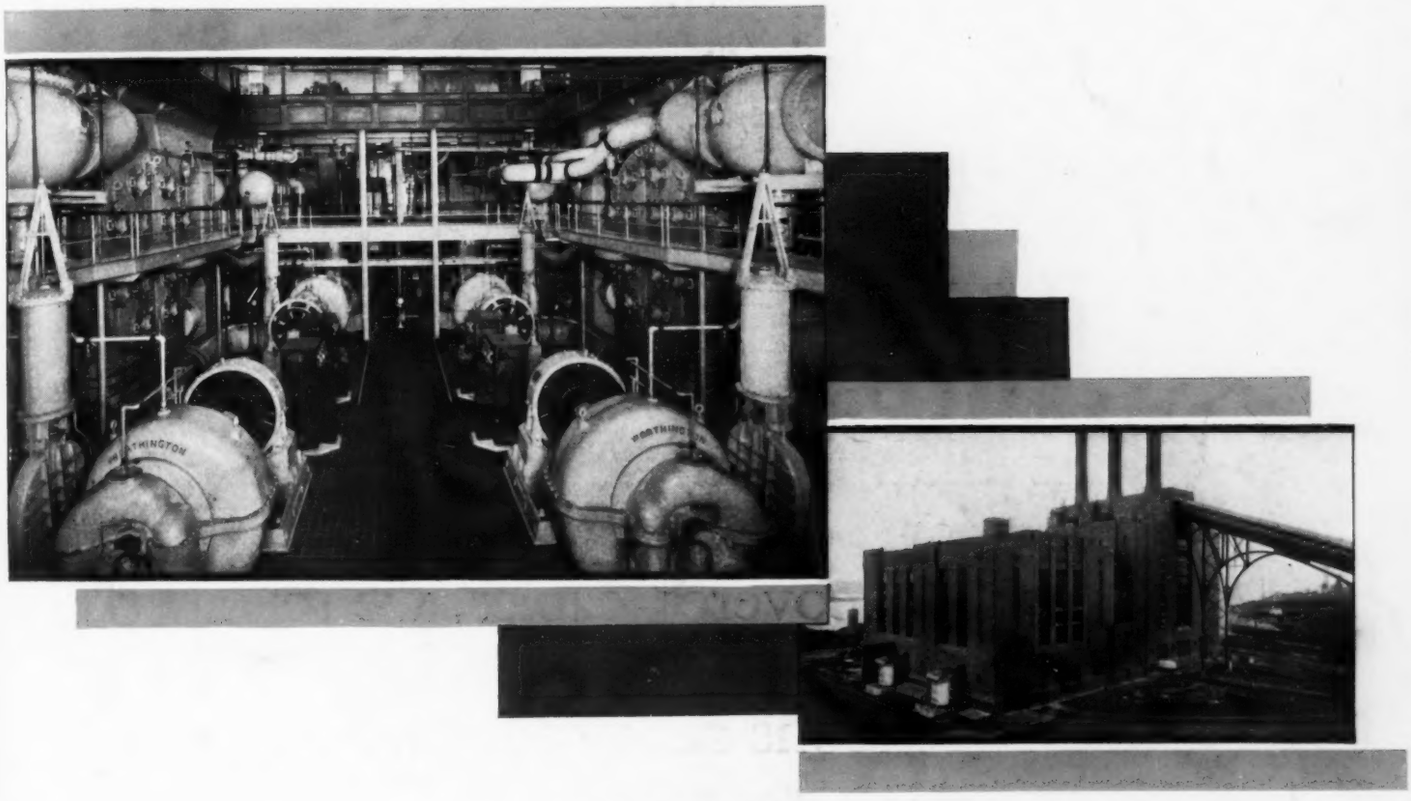

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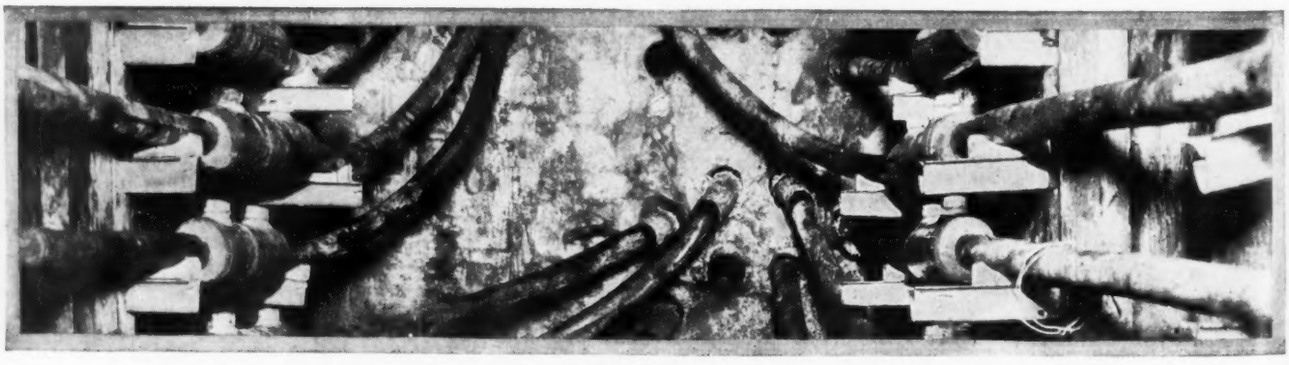

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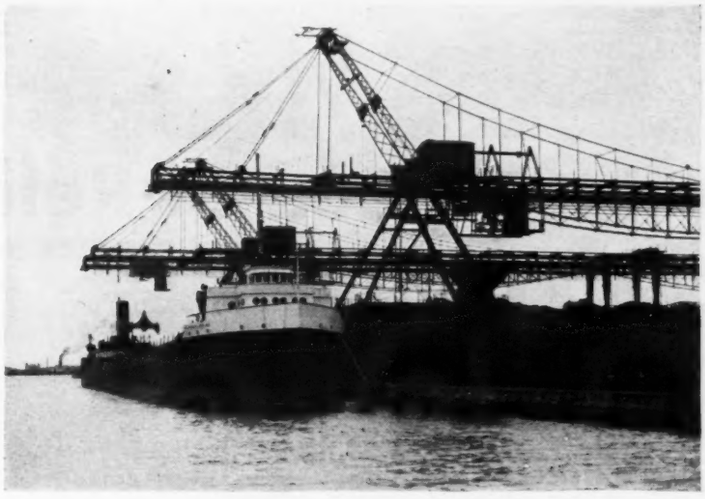

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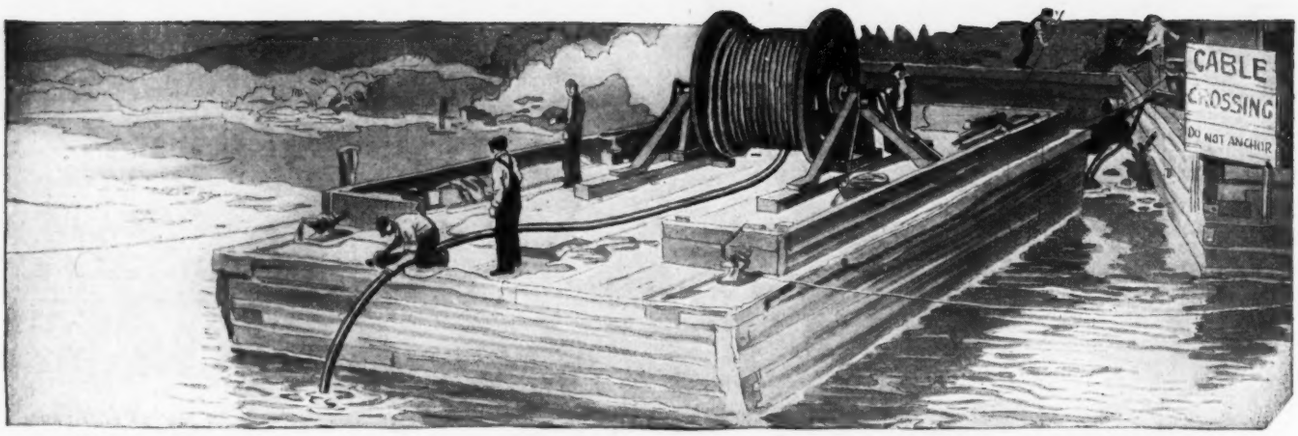

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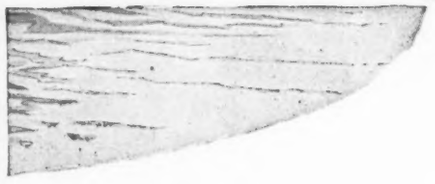

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EDITORIALS

L.W.W. MORROW
Editor

State Regulation Again Championed

"THE question of rates is the only one which seriously interests the public, and it is in fact the key to the whole situation. If rates are reasonable, there is little purpose in an investigation of the conduct of the industry."

In these sentences the Massachusetts special commission whose report on the state of the power industry and changes needed in laws governing it went to the Legislature last week expressed the truth with a courage none too prevalent in political circles. As readers of our news summary will surmise, the commission did not paint a fatuous picture of an electrical Paradise in the Bay State, but it coupled its recommendations for legislation strengthening the power of the Department of Public Utilities with some very sound observations on private ownership and managerial ideals.

The power industry has had regulative troubles in Massachusetts—everybody knows that; but the special commission recognizes that these problems can be solved without running to Washington, whether one agrees or otherwise with the recommendations of the present report. In this recognition is a clear-cut desire to face the facts in such situations at home.

The commission acquired a remarkable grasp of the major developments of the industry during its investigation. It went on record in its comments as seeing little use in trying to stem the tide of centralized development, and it frankly admitted the trend toward unification of financial control. Various possible abuses of the holding-company principle gave the commission much concern, but along with this went a substantial recognition of the great possibilities for good in this form of administration.

Some of the changes in the laws recommended by the commission are designed to bring the power of publicity to bear upon the relations between holding companies and subsidiaries as a means of preventing such abuses. Comparatively little evidence appeared in the full report that such abuses have been at all common in Massachusetts, although not all these combinations have as yet reached full favor.

Certainly, publicity is a powerful weapon, and its value cannot easily be exaggerated as a better means in many cases than laws to bring about reforms when needed. That holding company contracts should be regulated by commissions seems on the whole undesirable to the special body reporting in this case; it appreciates the undesirability of putting managerial powers in the hands of state boards supervising utility affairs. It is hard to read the complete report without feeling that a conscientious effort has been made here to serve the public welfare without political bias.

Selling Appliances in Multiple

ALL units in the electrical industry are striving toward one thing—complete electrification of the home. The key to prosperity lies in selling to each home as a unit the appliances and the service that should be used. Slow progress has been made toward reaching the goal, and it may be that a better and more economical method than the one now used can be found to electrify the home. At present the householder is approached

for the sale of one appliance only at one time; a big "spread" is required between appliance manufacturer and appliance user; sales terms vary; installation and wiring costs are handicaps to household buying. On this historical basis a rather disconnected and expensive distribution system has grown up.

Thought is being given to an entirely new method of approach through a better industry sales organization. The germ of the idea is in the story of the British Columbia Electric Company's "one-sale" plan published in this issue. But the principle can be carried much further. Assume that the utilities and the dealers in one city or territory form a co-operative buying agency for all heavy-duty and expensive appliances and that this central buying body purchases in volume from a group of manufacturers. Assume that the utility and the dealer-salesmen sell the complete electrification to each home and requisition from the central warehouse the appliances sold. Assume further that a national financing house handles the paper for each sale on a 6 per cent basis, so that the householder merely makes a small payment down and then pays so much a month over one, two or three years. Assume that the organization is perfected to install the appliances completely and service them as part of the "one-sale" plan and that all sales agencies sell on the same terms and get the same sales aids, such as advertising, display and demonstration. In a sense the plan involves mass buying, uniform selling, complete selling and a unity in the industry organization to supply each home.

The really great gain would be to increase the appliance volume of sales from 20 to 30 per cent, reduce the first cost of appliances appreciably, attain mass production in manufacture and volume purchasing, give terms of payment that will compete with other business for the consumer's dollar, and relieve the householder from piecemeal purchase of appliances, troubles with wiring, installation and servicing, and large initial outlay.

There is no easy path to such a method of industry growth, but it is well to study the possibilities of the plan. At present progress is slow and business rewards are meager. Radical thinking may evolve a far more satisfactory industry organization and plan for bringing the complete electrification of each home. At the least an analysis, directed toward improved practice, should be made of the present organization in terms of costs and results.

A World in Eclipse

NOT long ago an editor of the ELECTRICAL WORLD made a pleasantly diversified journey through one or two Eastern states.

There was a great and prosperous industrial plant the name of whose founders is known throughout the world. "Why," asked the editor, "don't you modernize the lighting in this shop?" Feebly inadequate bare lamps in rusted and dirt-filmed reflectors hung high overhead. Intensities were low, placements poor, working difficult. For the fourth or fifth time a young worker passed her hands nervously before her eyes as though to brush away a barrier. "Don't judge us by this," said the plant superintendent. "We are in the transition stage now. When we have completed our building program you will see a real job. Two years from now this will be a model shop." "Yes," thought the editor, "founded half a century ago, but two years from now the workers shall have light. In the meantime a few hundred dollars for fixtures and lamps and a few indifferent pennies for additional kilowatt-hours would save undeterminable strain on employees."

There was a great hotel-sanitarium. "Why," asked the editor, as he stood in the uncomfortable glare of many bare but frosted lamps depending from beaten annuli of iron, "don't you use modern fixtures that will eliminate glare and emphasize the charm of beamed ceilings and oaken woodwork?" "This," said the proprietor, "is not a Park Avenue hotel; we want to create a semblance of less effete civilization." "Yes," thought the editor, "a health resort with lighting so bad that ten o'clock sees the guests in their rooms."

There was the office of a great organization keen in its interest in industrial America. Over the heads of busy workers hung a lighting system designed and installed by one of America's leading illuminating engineers but horribly impaired by burned-out lamps and unwashed diffusers.

These are not isolated instances; they are but the first of many that come to mind. Light is

cheap. Light is vital. Light can reduce lost time due to illness, increase production, improve morale, prevent the nervous exhaustion that accompanies the doing of tedious tasks under pressure of speed and concentration. But America still gropes in unwarranted darkness.

Labels Limit Use of Meters

TOO frequently men think of things in terms of their designation only and unconsciously exclude from their minds all other applications than those indicated by their labels. For example, certain classes of electrical instruments, like demand meters, are widely used for the purposes originally intended, but they have not been so widely applied outside of that field as they might easily and profitably be.

To the average engineer "maximum demand" is tied up with the billing, and this mental connotation unconsciously tends to exclude the demand meter from consideration for other uses. For instance, an engineer wants some load data on a transmission line. He installs a curve-drawing wattmeter and collects yard upon yard of load record which is carefully gone over to determine what the peak load was. He does not care when the peak occurs or what the shape of the load curve is. All he wants to find out is whether the line is overloaded at any time. Or an industrial engineer may have a suspicion that a certain circuit is sometimes loaded to the gunwales, but the suspicion is not strong enough or the circuit is not important enough to justify the installation of a complicated instrument for detailed observation. In the one case the desired information could have been obtained much more easily from a maximum-demand meter; in the other case the suspicion could be displaced by exact information if the circuit in question were equipped with a demand meter.

While it is hardly reasonable to expect that names can be selected for all equipment which will indicate all possible applications, many users of equipment can find new and profitable applications for standard apparatus if they will discontinue thinking of them only in terms of their original purpose.

Licensing of Operators Needs Modernization

IN THE days of reciprocating engines and small low-pressure boilers the examination and licensing of operators of such plants seemed a desirable and even necessary procedure for the protection of life and property. Uninformed and untrained operators are a public menace and can cause much damage by their carelessness and thoughtlessness. Many cities and most states have passed legislation which provides for examinations and the issuing of proper licenses. This legislation is beneficial and proper.

The difficulty is that few states or cities have adjusted the administration of such laws to suit the changing trends in engineering. Many boards still give the old examinations, which have never become modernized. Certain rules are unfair. For instance, in one case a man cannot procure a license unless he has operated a 100-hp. boiler. In another he must have been in charge of a plant of 300 hp. before he can apply for a first-class license.

Now, the central-station operator—often a technical school graduate—may have gained his whole experience in a station of 100,000 kw. capacity. He may never have hand-fired or patched any boiler. Although he has had charge of every part of the equipment, he has not been in full charge of any complete plant. A license has frequently been denied to this type of highly trained man because of such technicalities, although he is quite competent to serve as a watch engineer.

Then there are license boards composed of old-time operators who are bitterly opposed to central stations and who endeavor to prevent any operator working for a public utility from obtaining a license, or to limit the number of first-class licenses to those who are members of their own group.

This situation has resulted in hardships to many of the younger central-station operators and has involved some utility companies in needless difficulties. It is in the interest of all concerned that the administration of these laws should be rectified. The public utilities would be justified in getting rid of the abuses that have gathered around otherwise desirable legislation.

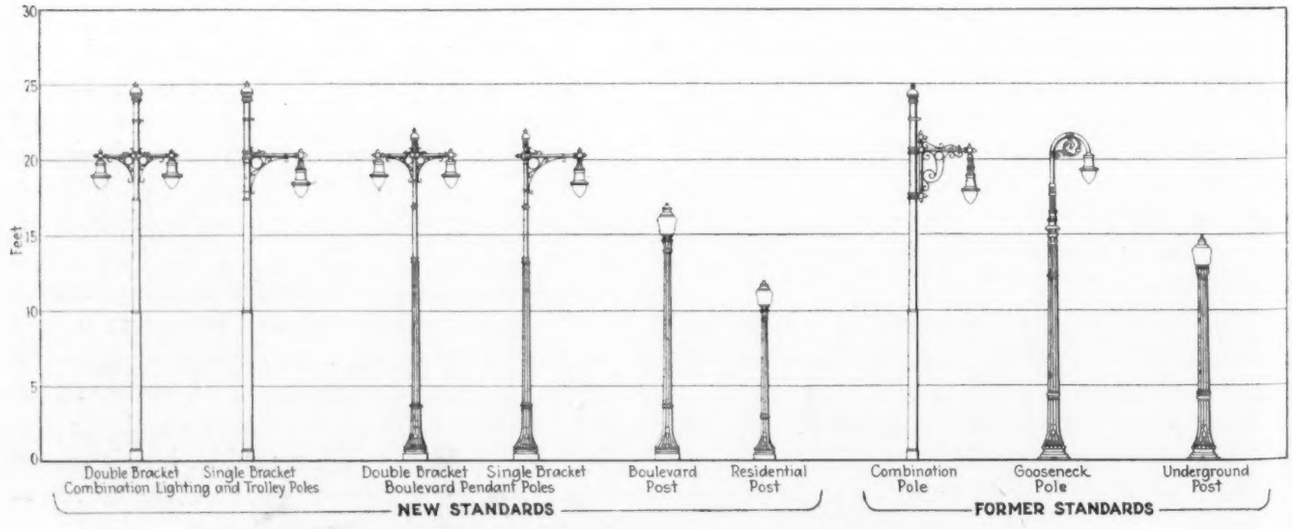
A standard 8-ft. street lighting bracket

Cutting Distribution Costs

REALIZING that the continual improvement of service to customers would necessitate increasing capital expenditures per unit of load, it was apparent that the capital costs of distribution must be kept at a minimum solely by more careful planning, improvement in circuit design and standardization of equipment and layout. The two general methods by which this company has succeeded in reducing capital cost in its distribution plant are by the adoption of more efficient methods of feed as applied to commercial and street-lighting circuits and by standardization of equipment and layout.

Under the former may be classified changes in our distribution system, such as the three-phase changeover, abandonment of d.c. service, utilization of combination power and lighting primaries and of combination underground secondaries, the adoption of secondary networks for dense load areas and the increased utilization of pole type constant-current transformers for street-circuit feed. While all of these changes have effected a reduction in capital cost, none of them is unique, and for that reason they will be discussed very briefly.

Under the second classification above are the standards of equipment, design and construction which have been developed by the engineers of the company to fulfill the particular requirements of this system. It is the purpose of this article to discuss some of the equipment which has been adopted as standard and which has shown a saving in unit capital cost over that previously used and also to describe some of the standards of layout and construction which by being designed for



Old and new street-lighting standards for underground zones

By THOMAS SPROULE

General Superintendent of Distribution
Public Service Electric & Gas Company

CONSTANTLY improved service is characteristic of the development of electrical distribution systems. In addition to continuity of service there are such other elements as the supply to different types of load, the installation of a flexible system that can meet changing load needs and the anticipation of load growth by installing capacity in advance of load.

IN THE distribution system exists a large investment, large operating charges and large maintenance charges. It deserves careful study, whether in a utility system or in an industrial plant. This article gives the methods used by a utility company in its endeavors to give better service at a minimum increase in cost.

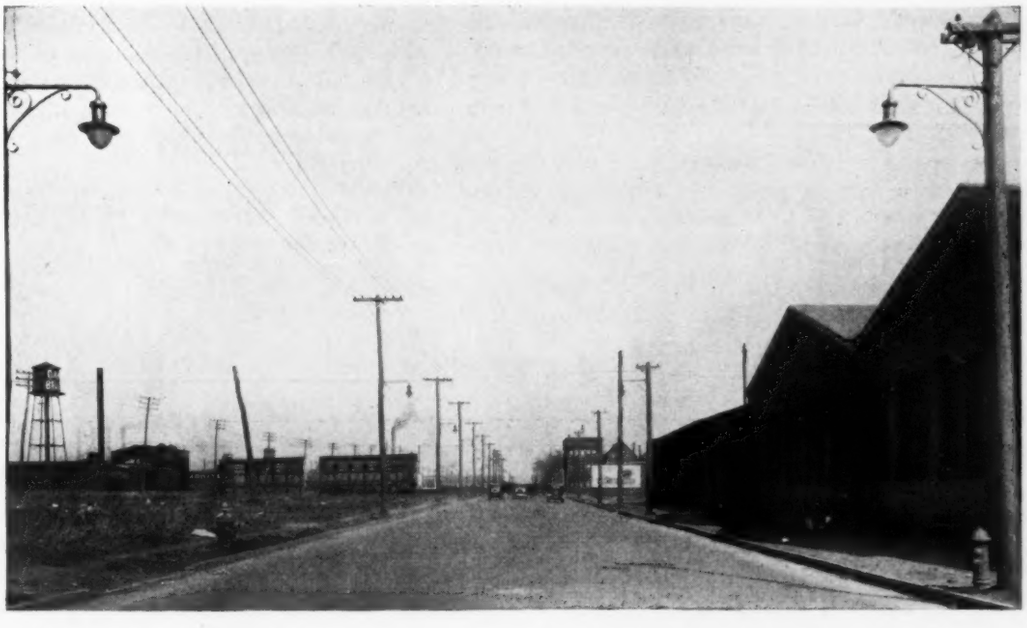
ease of expansion are effecting reductions in capital cost as the load continues to grow.

A 50 per cent increase in circuit capacity without changes in copper size or insulation standards has resulted in the change from 2,400-volt, two-phase distribution to 4,156-volt, three-phase, four-wire distribution. It has been found possible, without noticeably affecting the quality of lighting service, to use combination light and power primary circuits instead of a separate circuit for each. This saves two to four conductors on every street where power is required.

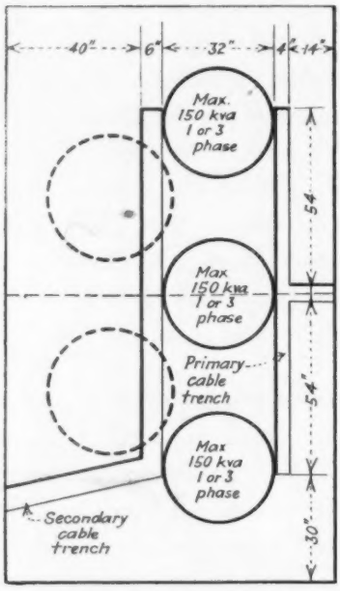
In the underground system three-phase, four-wire combined light and power 115/999-volt secondary mains have been successfully used in locations where the lighting load density is heavy and the power load is of such a nature as not to produce lamp flicker. Decreased investment in transformer units results from the smaller number of banks of larger size which can be used. Advantage may also be taken of diversity between light and power loads in certain localities.

Where the nature of the load demands a higher class of service complete automatic protection can be supplied by a combined light and power three-phase, four-wire network system at a very great saving over any other system which renders anything approaching equivalent service. The principal savings which are realized from a network system are as follows: Multi-conductor primary cable can be used throughout, large transformer units can be used with a minimum of spare capacity and all high- and low-voltage switching devices, with the exception of automatic network protectors at each transformer installation, can be eliminated. Network systems are now being installed in the central portion of several cities in Public Service territory. It may later be possible to serve the networks at primary voltages of 13 or 26 kv., saving substation losses and investment.

A very considerable saving has been accomplished through the standardization of underground conduit line construction. All conduit lines, whether for transmission, distribution or a combination of both, are built with the twelve-duct conduit run as a base. For trans-



Typical street-lighting bracket for general use



Plan view of 8x14-ft. manhole

mission only main line manholes are installed at 300-ft. intervals. For combination or distribution lines these main line manholes are constructed at street intersections, service manholes to which a portion of the ducts are connected are built between them and on the opposite side of the street. Transformer manholes may be built adjoining a main line hole or a service hole or may replace service holes built on the opposite side of the street from the main conduit line.

Transformer manholes are usually installed for a minimum of five years' load growth, but transformers are not set until required. This avoids the later expense of excavating and opening bonded pavements. Three sizes of transformer manholes are used—6x10 ft., 8x10 ft. and 8x14 ft. The 6x10 ft. manhole is used for residential districts where heavy loads are not expected for many years and will care for loads up to 175 kva. The 8x10-ft. manhole is used for districts where the load density is medium (400 kva. per 1,000 ft. or less) and is designed so that it may be easily enlarged to an 8x14-ft. manhole when the load requires it The 8x14-ft. manhole will accommodate 300 kva. in transformer capacity and a network protector.

In certain sections where only 6x10-ft. manholes had previously been installed and it has been desirable to make automatic network installations it was not considered economical to enlarge the manholes at this time. In some cases only 150-kva., three-phase capacity was required and in others 300 kva. was required under emergency conditions only. Two 150-kva., three-phase units can be installed with a network protector, as shown in the accompanying sketch.

Since the bulk of the load served by this company is concentrated in urban areas throughout the state, our line construction has until recently been designed exclusively for heavy loading. In extending our lines beyond the built-up suburbs of some of the towns it was realized that in many cases these lines would remain lightly loaded for a number of years to come, and it was therefore decided to adopt a cheaper type of construction for use in sections of this nature.

Distribution lines as constructed for normal city and suburban loading utilize class "B" cedar poles and insulated wires for both primary and secondary lines with an average length of span of approximately 125 ft. The standard adopted for rural line construction utilizes class "C" creosoted Southern yellow pine poles, which, in addition to being cheaper than cedar poles, have a somewhat longer life and are entirely satisfactory for this type of construction.

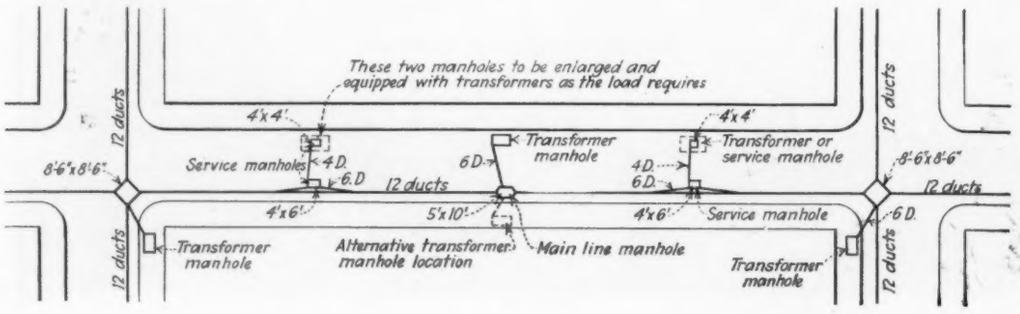
By adopting a span length of 250 ft. the number of poles is reduced by one-half, but the greater length of span necessitates the use of hard-drawn copper wire. In order to keep the cost of the wire at a minimum, it was decided to use bare wire in place of triple-braid weatherproof wire, which is standard in urban territories. No change was made in the type of crossarms, insulators and hardware or method of guying, so that the major portion of the saving is due to the decreased number of poles and the decreased cost of each individual pole. A number of lines have been constructed during the past year in rural districts at a reduction of approximately 40 per cent in cost as compared to urban construction.

A number of years ago, when the use of arc lamps prevailed on the company's street-lighting system, it was necessary to provide some means of lowering the lamps to facilitate the daily routine of inspection and trimming. This was made possible by the use of a boom type street lighting installation, with the lamp fixture suspended from a cutout pulley, which permitted lowering the fixture by means of a rope. The wiring was installed externally and the complete unit was similar to that shown in an accompanying illustration.

After the adoption of the incandescent lamp for street lighting it was no longer necessary to inspect the lamps at such frequent intervals, and it therefore became practicable to utilize a bracket with rigidly mounted lamp fixture. This change led to the development of ornamental scroll brackets for improving the appearance of overhead lighting installations on wood poles.

In order to provide satisfactory lighting under various conditions which are met in the territory, two sizes of bracket were designed, one being 4 ft. in length and the other 8 ft.

The 4-ft. bracket is intended for general use with 250, 400, 600, 1,000 and 1,500-cp. lamps in applications which require lights on both sides of the street and



Layout of a standard section of underground conduit line

for lighting on one side of narrow or average width streets.

The 8-ft. bracket is used with lamps of the above-mentioned sizes in applications of lighting on one side of the street or where heavy tree conditions make it desirable to use a long bracket. An example of the use of this bracket is given.

Both brackets are wired internally and utilize a series insulating transformer on the pole.

It is the present practice to use the ornamental brackets on all new overhead installations and to replace all worn-out boom equipment with the new style brackets whenever necessary.

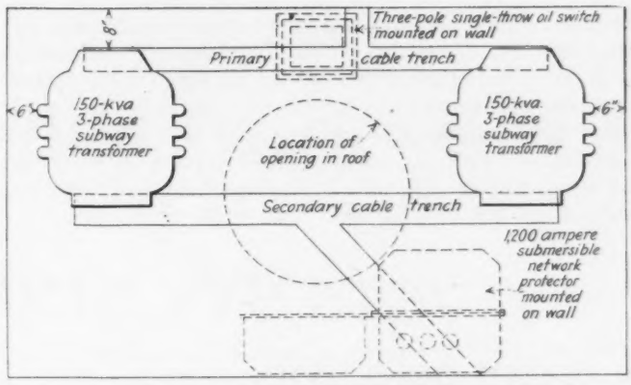
As to the matter of capital investment, it has been found that the 4-ft. bracket installation costs about 20 per cent less and the 8-ft. bracket 10 per cent less than the former type of boom suspension. From the inventory of additional street lights which were installed on these new brackets during 1928 an average lamp wattage per bracket can readily be calculated. By comparing this figure with the saving in cost of a bracket installation as against a boom, the reduction in capital investment can be expressed as an average of $20 per kilowatt of additional street-lighting load.

Street lighting, underground zones

A few years ago steps were taken to reduce the cost of the company's ornamental poles and brackets which are used for street lighting in the underground zones. The new standards which were designed are cheaper and at the same time more suitable for the various field conditions that are met.

In place of the old 14-ft. post and gooseneck pole, both of which were of very heavy construction, the company adopted three new standards, which are lighter in weight and more slender in appearance. Both the 16-ft. boulevard post and the boulevard pendant pole are used on main thoroughfares and business streets, the former having a post-top fixture and the latter supporting a pendant lighting unit. The 11-ft. residential post is installed on residential streets and in parks.

In comparing the boulevard pendant pole with the old gooseneck pole there is found to be a saving of 33⅓ per cent in the installed cost. As to the substitutes for the old 14-ft. post, the 16-ft. post represents a reduction of 10 per cent in the installed cost, while the 11-ft. post



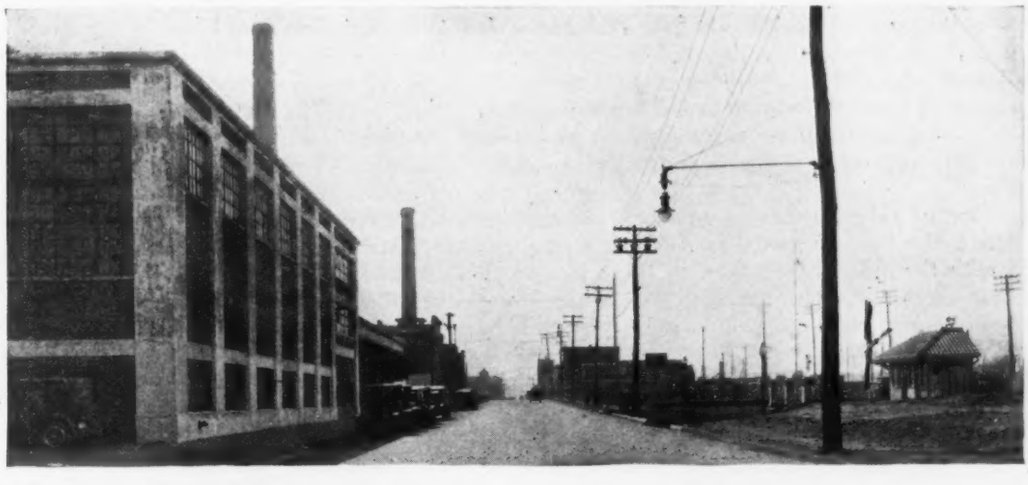
Arrangement used to avoid enlarging 6x10-ft. manhole when a network is to be installed

effects a saving of 25 per cent. A further reduction of cost in underground street-lighting standards has been accomplished by the redesign of an ornamental bracket which is mounted on trolley poles. The new type costs 40 per cent less than the heavier type which was formerly used.

Another factor in reducing the capital investment in street-lighting apparatus has been the use of pole type and subway type constant-current regulating transformers in place of substation type units.

Transformers of the former type have been used to advantage in outlying districts where it was desired to avoid long circuits back to the substation and in certain congested subway zones where the duct space was limited. They have also been used in cases where it was not practicable to add to the substation equipment because of space limitations in the building.

These constant-current transformers are controlled from the nearest street-lighting circuit extending from a substation and are energized from the 4,000-volt primaries. It is not considered desirable to feed the entire street-lighting system from outlying transformers, but it has been found that satisfactory service can be given by arranging the layout so that not more than three or four units are controlled from a single substation circuit or fed from a single primary circuit. This establishes an arbitrary limit to outages in case of failure of the control circuit or the primary feed.



Boom type street light installation used when arc lamps existed

The installed cost of a pole type or subway type constant-current-regulating transformer is considerably less than that of a substation unit. In making a comparison it is found that the average saving on pole type constant-current transformers, is about $20 per kilowatt, while with subway units it averages about $14 per kilowatt. In addition, there is an appreciable saving in wire and cable by reason of avoiding the installation of long circuits from the lighting load back to the substation.

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Current Selectivity Reduces Relay Time

By CHARLES B. CARPENTER

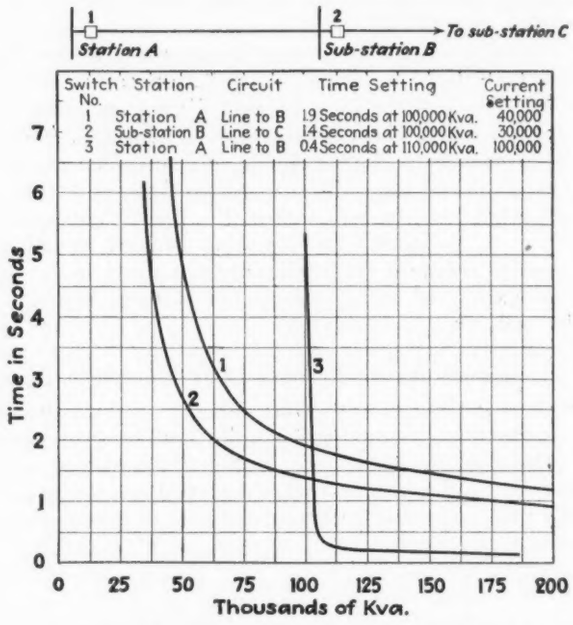
Formerly Engineering Department, Washington Water Power Company, Spokane, Wash.

SELECTIVE action of overcurrent relays is usually obtained by making time the major factor in the setting. That is, several relays in a series of installations may all have practically the same current setting, while the time settings are properly stepped to obtain selective breaker action. Selective action is easily and reliably obtained by this method, but it is also true that the relay nearest the source of supply on a line having several sectionalizing points may have a setting so high in time that a close-in short circuit would cause the system to become unstable.

The Washington Water Power Company has been using relays with very low time settings, set for selective action as to current. For example, the accompanying illustration shows generating station "A" feeding substation "B" over a transmission line, the short-circuit current at "B" from "A" being 100,000 kva., while with the short circuit near "A" the value from "A" is 200,000 kva. Suppose switch No. 2 has a setting as illustrated by curve 2, this necessitating a setting for switch No. 1 as shown by curve 1. An inspection of the curves shows that for a short circuit near "A" the relay on switch No. 1 will require 1.2 seconds to operate, which is much too long to allow a fault at that location to remain on the system. Another relay set for very low time with a minimum tripping setting of 100,000 kva. (see curve 3) will not operate on trouble beyond "B," but trouble between "B" and "A" will be cleared in from 0.4 to 0.15 second, a gain in time of from 1 to 1.5 seconds. This great reduction in time will in many cases be of major importance in maintaining stable operation of synchronous machines.

This method of relaying can be used only on sections of line where the line reactance is sufficiently high as compared with the system reactance, so there is a much greater short-circuit current through the switch being relayed, with a fault near the switch, than there will be in case of a fault at the far end of the line.

A relay for the purpose suggested must have three features: (1) Low time settings; (2) high current taps, and (3) current setting adjustable between current taps. The low time settings are necessary to obtain a time-current characteristic as shown by curves 1, 2 and 3. The high current settings necessary for this method of relaying require the use of current transformers with abnormally high ratios or relays with coil taps for minimum operation at currents from 12 to 50 amp. Relays with special taps are cheapest, especially when account is taken of the fact that a relay which requires 30 amp. for its operation imposes a very small burden on a current transformer at ordinary load currents. In order to take full advantage of this method of relaying, it is necessary that the current setting can be adjusted continuously between current tap ratings.



Curves determining relay settings for a specific problem

The ordinary plunger type instantaneous relay has been found to be unsuitable for this service, as experience has shown that it is impractical to maintain the current settings within proper limits. The slight time delay inherent in the induction relay allows subtransients time to die out and therefore allows closer current selectivity.

A prominent manufacturer has been furnishing the Washington Water Power Company with induction type relays which can be set to trip in 0.4 second with only 10 per cent more than the minimum operating current, while the relay will operate in 0.15 second with 200 per cent of its minimum operating current. A shading coil for adjusting the minimum tripping current is standard equipment with this relay. Current coils also have been furnished with taps from 12 to 60 amp.

Experience has shown that where relays of this type are installed a large percentage of relay operations will be from the high-speed relays.

It should be understood that the high-speed, current-selective relays are used in addition to, and do not replace, the ordinary time selective overcurrent relays, as it is necessary, as a factor of safety, to leave gaps in the line which would not be taken care of by this relay.

Avoiding Customer Annoyance and Saving Money

Inconvenience and expense of duplicating gas and electric service facilities eliminated by combining activities

By E. P. PREZZANO

Vice-President Westchester Lighting Company

A NEWSPAPER in a large Eastern city recently carried a cartoon calling attention to the annoyance caused the average residential customer by the lack of co-ordination of service activities on the part of utility companies.

The cartoon showed Mrs. Suburbanite surrounded by a group of representatives from the gas, electric, telephone and water companies. Three men had called to read the meters in the cellar, one man had called to adjust the burners on the gas range, another man was working on an electric vacuum cleaner and the telephone man was pulling wires through the house. The street in front of her home was lined with automobiles from the various utility companies and Mrs. Suburbanite showed her displeasure at the annoyance she was caused by having to answer the doorbells for so many utility company representatives. If there is one thing the average woman dislikes it is to answer doorbells for the numerous canvassers, peddlers and other itinerants who infest suburban communities.

The experience of Mrs. Suburbanite is typical of the experience of customers in all sections of the country. Despite all that has been said on the subject, there is still much duplication of service activities on the part of combination gas and electric companies, and this is not only costly to the utility but it is also annoying to its customers.

Some years ago a study of this subject was undertaken by the executives of the Westchester Lighting Company, which furnishes gas and electric service to some 44 municipalities throughout Westchester County, covering an area of more than 450 square miles directly adjoining New York City. Within this area there are approximately 500,000 residents and at the present time 265,000 gas and electric meters are in use. There is comparatively little industrial development in this territory; it is almost entirely a suburban residential community. Eleven district offices are maintained in this territory and, due to the large area to be serviced and the rapid growth of the community, the company operates some 400 automobiles. These vehicles are used for construction, maintenance and service work and enable the company to render prompt service to its customers, despite the distance to be covered.

As a result of its study the Westchester Lighting Company found that it was entirely practicable to eliminate many forms by using a single application for gas and electric service, a single ticket for executing gas and electric service calls, a single ledger for gas and electric customer's accounts, a single bill for all services rendered, etc. It was also found that one man could cover both gas and electric service calls, saving not only time and expense but also enabling the company to render more satisfactory service to its customers. These are but a few of the activities which it was found desirable to combine and which have since proved capable of satisfactory co-ordination.

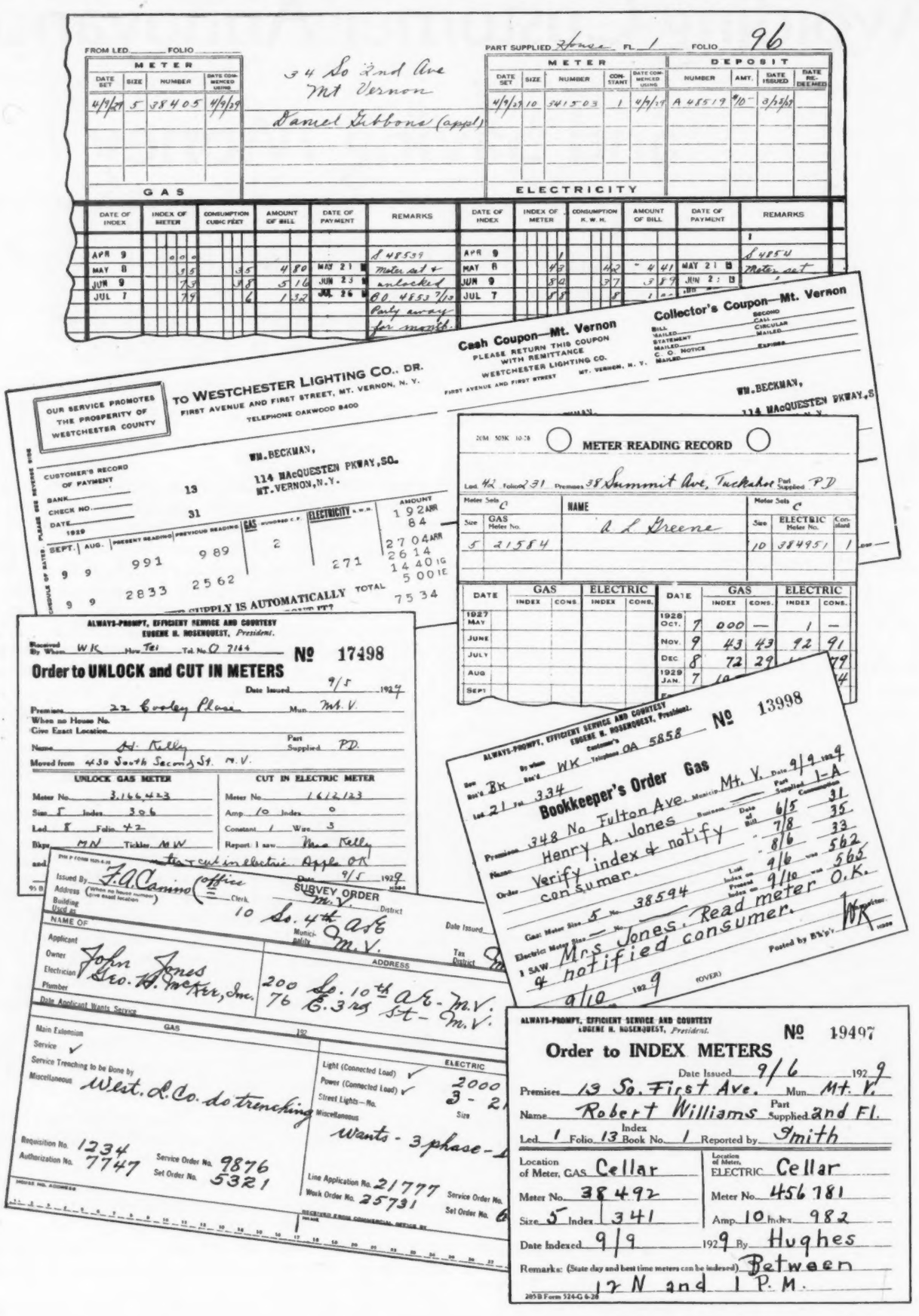
The problem which was faced by the company is no different from that which confronts many other combination companies. When the plan was first outlined it was considered by many to be impracticable; that gas service men could not be trained to cover electric service calls, or vice versa. Some even went so far as to say that a man trained to sell gas appliances could not sell electric appliances satisfactorily. However, after several years' experience the results speak for themselves and today you cannot find one person in the organization who would willingly go back to the old routine.

Our procedure for handling combination activities from the time a customer makes application for service until it is discontinued is as follows:

Application for Service.—New residents may obtain both gas and electric service by signing a single application.

Unlocking Meters.—If gas and electric meters have already been installed in the building, a single ticket giving the combined order is issued and both meters are unlocked by a representative of the customers' service department, who at the same time examines all gas and

To Avoid Customer Inconvenience and Work Duplication



electric appliances on the premises and makes any adjustments or repairs that may be necessary.

Survey for Extension of Service.—If the applicant desires service in a new building, a representative of the inspection department visits the premises and secures all data necessary for furnishing both gas and electric service, including any extension of gas mains or electric lines that might be required. These data are recorded on a form known as the "Survey Order," which is then used for following up the various orders until service is supplied. Previously it was our practice to send representatives from the gas engineering, electric engineering and commercial departments to secure the necessary information, but now only one man contacts the owner or builder to secure the data, eliminating much annoyance to the builder and expense to the company.

Telephone Order Department.—All requests for information or service, regardless of its nature, are received by the telephone order department. Here a single clerk answers all inquiries and issues orders to the proper department for execution. This obviates the necessity for transferring a customer from one department to another before obtaining the information desired. This department is located apart from the regular service clerks so that they may give uninterrupted attention to telephone inquiries.

Indexing.—The indexer reads both gas and electric meters, placing the readings on a combination route book. Where it is not possible to read meters at the time the indexer makes his regular call a combination gas and electric skip ticket is issued.

Bookkeeping.—When the shop reports that a meter has been unlocked the ticket is sent to the bookkeeping department, where an account is opened in a loose-leaf combination ledger. After the index has been entered in the ledger the bookkeeper computes the amount of the bill, and from this information the billing department makes out a combination bill, including any amount due for appliance sales. All arrears for gas and electric service, as well as any other indebtedness due the company, is also shown on the bill, which is then totaled, enabling the customer to tell at a glance his total indebtedness to the company. Not only is this a convenience to our customers but it also obviates errors which occur when the customer attempts to add up the charges for gas and electric service, together with arrears, if any.

Credit Work.—After the bills have been checked they are sent to the credit department and from this department all bills are mailed. Here all credit work for gas and electric service as well as appliance sales is centralized. Combination forms are used wherever practicable. When bills are paid the combination cash coupon is sent to the bookkeeping department for posting in the ledger. When a customer moves, a single ticket is issued and a representative from the customers' service department discontinues both gas and electric service at the same call. All high bill complaints for gas or electric service are investigated by a representative of the special service department, who is specially trained to handle work of this nature.

Appliance Sales.—We sell all types of gas and electric appliances and during the current year our sales should approximate $1,300,000.

The territory covered by each operating district is divided into four or more selling districts and a combination salesman is assigned to cover all domestic gas and electric sales in a particular district. At one time it was our practice to have one salesman cover all types of gas appliances and another man to cover all types of electric appliances. Now one man sells both types of appliances, and this arrangement has proved far more satisfactory, not only to the salesmen but also to the customers and the company.

Appliance Inspections.—We do not wait until our customers' appliances are in need of attention. We endeavor to anticipate such calls by a periodic inspection of all

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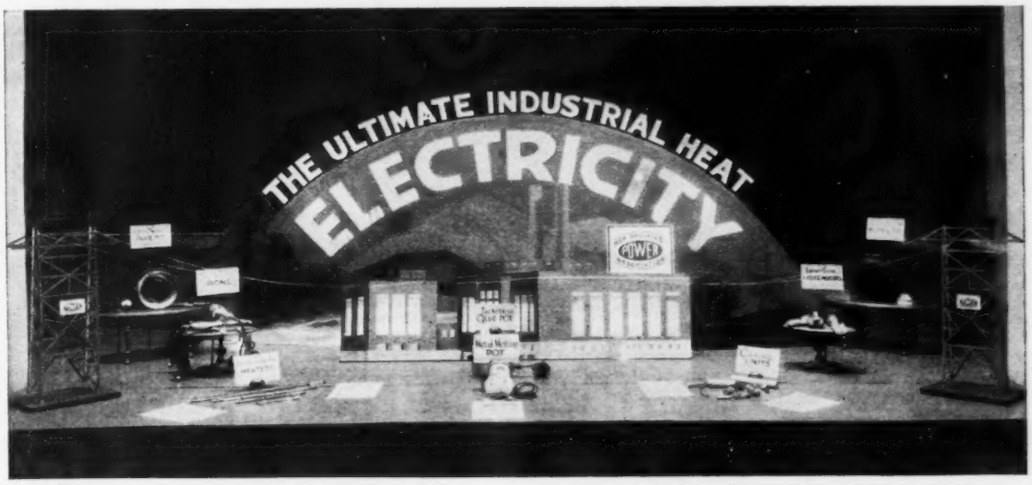

EFFECTIVE INDUSTRIAL ELECTRIC HEATING WINDOW DISPLAY

at Lowell and Lawrence, Mass., arranged on subsidiary properties of the New England Power Association to feature the type of heating equipment most applicable to local markets. The "set-up" tied in with a national manufacturer's campaign.

appliances on our lines. This work is carried out by a group of specially trained young men who make calls from house to house and inspect all types of gas and electric appliances, making minor repairs and adjustments and reporting the need for major repairs, which are done by the customers' service department.

Our appliance inspectors, as these representatives are called, have accomplished much for both the customer and the company. They have built up good will by giving a free service unsolicited. They have facilitated future sales work by giving information to the sales department as to the distribution of appliances in the district. They have made satisfied customers and kept appliances in every-day use which might have been put away on the shelf due to some minor trouble. At the same time, through inspection of gas tubing, piping, and flue connections, we have been able to correct dangerous conditions which might have led to more serious consequences if not corrected.

Service Calls.—All service work on customers' premises, both gas and electric, is covered by the customers' service department. This department delivers and installs all types of gas and electric appliances, except house-heating boilers and water heaters, which are installed through a co-operative arrangement by local plumbers. This department also executes all gas and electric service calls, maintaining all types of gas and electric appliances, including house-heating boilers and water heaters. We have adopted a very liberal service policy and make no charge for any service calls, except for material used which sells for more than $1. When a representative of this department calls on a customer he is instructed to ask if any other gas or electric appliances are in need of attention. In this way we have been able to bring into active use many appliances which have been stored away in closets because of some slight defect which could be repaired in a few minutes. By having combination maintenance men we are able to execute such calls while on the premises and in this way improve our relations with our customers.

Summary

A program of this character requires active executive support. Interested department heads will naturally be averse to giving up any authority and will offer all kinds of objections as to why such a plan will not work and why it will be done better if left under their supervision. Our experience of several years has proved to our entire satisfaction that such a plan is entirely practicable and desirable both from the standpoint of the company as well as the customer.

We are still studying additional combination activities. For example, we recently arranged for the installation of underground electric service conduits by the same group of men who install gas services. We are now considering the practicability of installing gas and electric services and meters by the same department at the one time, but until we are convinced that the combination of such work will prove economical or otherwise advantageous to the company and the customer we will limit our combination activities to those outlined herein.

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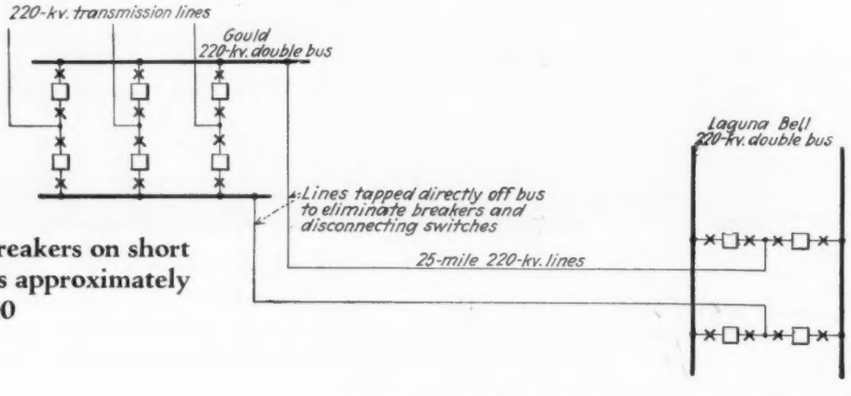
Breakers Omitted on Short Lines

BY CONSIDERING short transmission lines as bus extensions the Southern California Edison Company effected a saving of approximately $200,000 in its 220-kv. Gould substation through the elimination of oil circuit breakers and accompanying disconnecting switches. Gould substation is a 220-kv. switching station for the two 220-kv. Big Creek lines and the 220-kv. Vincent line. Two 220-kv. lines approximately 25 miles in length extend from this station to Laguna Bell, as shown by the accompanying sketch. By considering these two lines as extensions of the Gould bus four 220-kv. oil circuit breakers and eight three-pole disconnecting switches were eliminated at the Gould end of the lines. The scheme has been in successful operation for several years.

Although the very large saving mentioned was effected, the scheme has the operating disadvantage that a great deal of switching is required to clear one of the lines in case it develops trouble or it should be required to take the line out of service for maintenance. However, little trouble has been experienced in two years of operation and it is purely a question of operating flexibility as against much lighter capital cost in substation construction.



Omission of 220-kv. breakers on short transmission lines saves approximately $200,000

Co-operation as One Architect Sees It

An interview with

WILLIAM VAN ALEN

Architect, New York

Ewing Galloway.

So much has been said by electrical men about co-operation with architects. So much that does not explain a great deal. The man whose materialized dreams rise skyward in the unique Chrysler Tower—it is the world's tallest building—has a few ideas that ought to jar complacency a bit

"CO-OPERATION with the men of the electrical industry would be more welcome if, speaking frankly, they knew what they were talking about," said Mr. Van Alen when asked for his views regarding the co-ordination of efforts of electrical and illuminating engineers and architects. "Tangible information that I could accept with assurance as to how to obtain certain definite lighting effects would be heartening indeed, but it is not forthcoming. Time after time, during many years of experience, I have had to battle with lighting experts who wanted to do things as they had always been done, or with variations, but who would not or could not supply the data and materials that would enable me, as the architect with the concept of the results desired, to accomplish what I wanted. What I expect and can use from the great research laboratories and electrical experts are facts, not ready-built fixtures or preconceived notions of how an office entrance or elevator bay or floor layout should be handled.

"The architect is constantly confronted with the problem of securing materials with which to produce the results that he has visualized. As the individual with the conception of what is to be, he alone knows what is to be acceptable. In the Chrysler Building elevator foyer I desired to secure a diffused lighting effect wholly free of elements which might be identified as lighting fixtures.

This entrance is a triangular space through which people are to be guided by definite floor designs and lighting to reduce ingress and egress time to the minimum. I wanted to have a relatively large, low-intensity, geometric figure of paneled glass over each elevator entrance and to illuminate similarly two large columns which will break up the traffic streams. The only other light source was to be at the information desk. My consultants held out for various fixtures here and there—impossible to light the space otherwise, they told me—but during construction work two lone lamps furnished adequate light and my scheme is going to work satisfactorily. I could give you innumerable examples.

"Not one of all the lighting experts who were on this job told me, or apparently knew, that if we used the amber glow contemplated at one time the polished white metal trim would be "killed" so far as effects were concerned. None suggested that in a portion of the tower to be floodlighted according to a most unusual scheme it would be preferable to protect the sources by inclosures rather than to leave them exposed, but when I suggested it after considerable thought they chorused, 'Oh, yes, and you will prolong the life of the installation by at least ten years.' They appeared too anxious to please and to be comparatively short on both facts and imagination.

"The Chrysler Building is unlike any other that has ever been constructed, yet this individuality of design and appearance has been achieved without any additional expense, except where major expenditures were made to insure reduced maintenance costs. Some electrical features are really radical. The vertical distribution system with 13,200-volt feeders running directly from the United Electric Light & Power Company lines to transformer vaults in the basement and on the 30th, 60th and 73d floors has never been used before, but this, and the alternating-current network distribution system used with it, is the result of the architect's recognition of the possibilities following utility company practices near the doorstep of his own home.

"To load up the floors and ceilings with copper throughout in the expectation of heavy energy requirements for unit floor space might be satisfactory to engineers, but it isn't good business and it isn't good judgment for the architect. We figured 2 watts per square foot as the proper allowance for general office space. Where higher intensities were requested by prospective tenants they were, of course, allowed for, but in my judgment that figure is generously adequate.

"If we are to have much greater foot-candle intensities than any ever before contemplated," said Mr. Van Alen in response to a suggestion that the future might offer a vast upset to present good practices, "then we may expect greater efficiency of production at the light source. Illumination engineering and lamp manufacturers are, I hope, still progressing.

Networked vertical distribution

"The entire rental area of the Chrysler Building has been laid out in bays. Overhead conduit runs are so located as to afford ceiling outlets within these bays, in relation to columns, windows and hallways to meet any reasonable need. Underfloor fiber ducts permit pick-ups for further flexibility both for high- and low-tension work. Control may be effected at any column. Metering may be done by floors or by unit areas. Networked feeds insure utmost reliability and minimum voltage drop. These arrangements must vary greatly according to the architectural layout of the particular building considered and the available office space planned. All this is a problem for the architect to decide upon the basis of such reliable evidence as may be available or established by experience. Installation is the engineer's job.

"Thus, it seems to me what we architects want to know about lighting and the engineering that goes with it may be summed up quite roundly in 'technical facts' rather than 'commercial considerations,' for the architect must be more than fairly good commercially in his own right if he is to last. We know what we want. The engineers should tell us how to obtain it. But," and here seemed to be the real point of Mr. Van Alen's view, "they will have to learn the facts for themselves before they can tell us."

"Don't think for a moment that competent architects are asleep on the job when it comes to electrical matters. Of course you will find inadequate wiring in old buildings, but who can look ahead to certainty? Who could have foreseen today from the past? One must use his best judgment, balancing today's experience against tomorrow's apparent trends. It would be absurd to go to an extreme, for capital costs, economic considerations and probable use limits leave relatively little over which to wrangle if a high-grade job, completely thought out, is to be secured."

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Samuel Insull Says:

It is a perfectly natural thing for a farmer to have more or less resentment against the power company whose high-tension transmission line crosses his farm, unless provision is made to give him service locally. In addition to educating the farmer as to the desirability of electrification, I think that this committee (Illinois Committee on Public Utility Information) could perform a very desirable function, and one of great advantage to the industry, if it would educate the managers of our properties to know that the farmer whose acres are crossed by our transmission lines is just as much entitled to service as is the householder in the house or flat in the city, where our mains pass his door.

Our Employee Relations

An Interview with

C. C. CHESNEY

Vice-President General Electric Company

"THE average cost of living has increased in this country 67 per cent on the basis of 1914 prices, but the average wages have increased from about $800 a year in 1914 to about $2,200," said Mr. Chesney when asked recently to outline the General Electric employee relations policy.

These figures, he said, indicate what is almost a revolution in the theory of management. It was formerly supposed that the way to increase profits substantially was to lower wages. Now the more progressive concerns are aware that good profits are not at all inconsistent with increased wages. Better pay for workers, in fact, is one of the recognized means of achieving the new goal of increased output for individual workmen.

Wages and security, of course, constitute the fundamental employee-management relations. And it is recognized that employee benefit plans must always be strictly subordinate to them. In regard to the first, the General Electric Company has consistently maintained a high average wage as compared to the country as a whole. It sees no reason for placing a restriction on the amount to be earned by any factory employee, and considerable experiment, with a view to increasing both productivity and earnings of the worker, has been carried on. In regard to the second, annual reports of the company have referred repeatedly to the problem of unemployment, and plans for reducing the fluctuations of employment are constantly being considered. Such schemes as manufacturing for stock and rotating work are employed when there is need for them, but it is admitted that the problem is far from solved. Until the more fundamental problem of the business cycle can be solved, the question of unemployment will remain a vexing one. But the General Electric Company, Mr. Chesney says, is fully aware that a reduction in wages or a temporary layoff can destroy overnight the results of the most carefully planned program of employees' benefit activities.

In a general way, according to Mr. Chesney, the General Electric policy is not so much to assist the employee directly, in a "paternalistic" way, as it is to offer the employee the means of helping himself. And the various General Electric plans may be divided, roughly, into two types. First are those which help the employee to protect himself against the eventualities of sickness, accident, old age and death; second, are those which offer him an opportunity for self-improvement and the increase of his well-being. Several of the former are felt to be of such pressing importance that they have been made conditions of employment. Others are in the nature of opportunities which the employee is welcome either to take or to leave.

We have a pension plan

Since 1912 there has been in effect a pension plan which provides for the payment of old-age pensions to employees of twenty years continuous service who have reached the age of 70 years (60 years for women). Disability relief is also granted to employees of twenty years' service who have become permanently disabled. About a year and a half ago an additional pension plan was put into effect. Under this additional plan em-

ployees with five years' service participate by paying 1½ per cent of their annual earnings to a fund. Since this contribution comes automatically from a semi-annual supplementary compensation of 5 per cent of their earnings, which employees receive after five years of service, it does not, in the majority of cases, affect the regular wages in any way. Money contributed to the additional pension fund, furthermore, may be withdrawn with accumulated interest if the employee leaves the company or is discharged. The fund is therefore simply a painless saving fund, with the employee receiving the benefit of expert investment knowledge. Yet its effect, estimating interest conservatively, should be to increase by over 50 per cent the size of pensions for the younger employees who are now beginning to participate in the plan, by the time they are ready for retirement. Furthermore, for employees who subscribe to the additional plan, retirement at the age of 65 (instead of 70) is optional.

Recently this plan has been somewhat revised, so that the percentage of salary paid into the fund varies with the age at which the employee starts to participate. This was done in order that an employee starting, say, at the age of 19 would not have to carry so large a share of the pension of the man who starts at 45.

Employees' mutual benefit associations are maintained in the various works of the company. In eleven works these associations have at present about 43,500 members, which is approximately 74 per cent of all factory employees in these works. This high percentage is all the more remarkable when it is considered that the benefit associations are purely employees' organizations, with their own officers and their own by-laws, and with wide local variations in organizations. The company contributes to these merely by allowing the automatic collection of dues by deduction from wages and by furnishing the necessary clerical assistance. Dues are 10 cents or 20 cents a week and benefits of $6 and $12 a week are paid in case of illness. Dues stop automatically when the surplus reaches a certain point and begin when the surplus drops to a specified minimum. During the past year more than a quarter of a million dollars was paid out as benefits to members.

CRITICS of the employee-relations policies of large corporations are of two kinds. One kind objects that the large corporation is inhuman and lacks a soul. The second kind objects that the large corporation is "paternalistic," which is simply another way of saying that it is all too human. Now, it is conceivable that a corporation might be either one or the other, but that it should be both inhuman and fatherly at the same time is hardly probable.

C. C. CHESNEY, vice-president in charge of manufacturing of the General Electric Company and a former president of the A.I.E.E., takes the view that the solution lies somewhere between these two opposing policies.

Loan plan a co-operative venture

In several General Electric plants there has recently been inaugurated a relief and loan plan, designed to augment the work of the mutual benefit associations. The employee contributes small weekly dues, and to the amount contributed by employees is added an equal amount contributed by the company. From this fund loans without interest are made to employees who require financial assistance, upon recommendations by a board composed of representatives of employees and management. A very small percentage of dues goes into an emergency relief fund, from which grants are made to pensioners when it is deemed necessary. This plan, which has been in operation only for a short time, has proved very popular and valuable, and it may be adopted by employees at other plants of the company within the next few years.

Insurance paid for by the company

The insurance plan, like the pension plan, provides certain benefits to employees at no cost, and other benefits to which they contribute. Group insurance ($1,500 maximum) is supplied free to employees, conditional upon their subscribing to insurance under an additional insurance plan. The additional insurance may be obtained at very low rates and without physical examination, and the amount which any employee may take out is governed by the amount of his wages. Subscriptions to the additional insurance plan is a condition of employment after five years of service.

The plans so far outlined have done much to safeguard employees and their dependents from possible financial distress and to render their position more generally secure. But to help employees who wish to embark on a definite plan of investment, the General Electric Employees' Securities Corporation has been organized. The bonds of this corporation are sold to General Electric employees only and bear 6 per cent interest, to which the General Electric Company adds another 2 per cent for employees. These bonds are backed by the securities of the General Electric Company and of public utilities and are consequently an exceptionally safe investment. The total yield of 8 per cent makes them even more attractive as an investment. It may be noted that the General Electric Employees' Securities Corporation is the largest single stockholder of the General Electric Company. Subscriptions to these bonds is limited to $500 a year for any one employee, and they may be bought in units of $10 either for cash or by weekly or monthly installments. More than 34,000 employees at present own or are investing in these securities, the average holdings being approximately $1,000. The purchase of bonds is entirely optional.

Through the schemes briefly outlined above—the pension plan, the mutual benefit associations, the relief and loan plan, the insurance plan and the General Electric Employees' Securities Corporation—the General Electric Company is helping employees to meet the economic crises in their lives. Except for pension and insurance, participation in them is entirely voluntary.

Following logically after these comes the plan of the company for assisting employees in buying homes. This plan was originated by Mr. Chesney nine years ago, when he was manager of the Pittsfield Works of the company, and it has proved so successful that it has been extended to all of the other plants of the company. The first necessity, Mr. Chesney points out, is that the employee provide for his dependents in case of death—by means of insurance. Next come the relief and loan plan and the benefit associations, to provide for illness and unexpected emergencies. Third in importance is provision for old age by means of adequate pensions. Fourth is the necessity for providing means of saving. And fifth comes assistance in securing a home. This is, roughly, the place of a home-ownership plan in any well-considered program of employee benefits.

Through its home-ownership plan the company assists employees by financing second mortgages at 6 per cent for one-half of the amount of the first mortgage. Thus the employee not only receives reasonable consideration, but secures his mortgage at a rate considerably less than that commonly charged for second mortgages. Homes to the value of more than $11,000,000 have so far been bought by employees with this assistance from the company.

THE General Electric Company is opposed to paternalism, Mr. Chesney says, in the sense of seeking to influence the lives of its employees beyond the point of securing them adequate comfort, financial security and satisfactory working conditions, yet it feels a very definite responsibility up to this point.

There remains that second large group of employee benefit activities which has already been referred to—those which are designed to help the ambitious employee and to contribute, in so far as he cares to take advantage of them, to the happiness and the well-being of the employee.

It is a fact not widely known, says Mr. Chesney, that only ten of the educational institutions in this country offer facilities for instruction to more students than does the General Electric Company. A variety of apprentice courses, open to ambitious young men who wish to learn a trade, is maintained. The company at present employs approximately a thousand apprentices. More than 3,300 have so far been graduated, many of them having worked their way into responsible positions in the manufacturing organization. A test course, in which there are now about 500 engineering graduates, is maintained to give students a practical engineering training to supplement their theoretical knowledge. Approximately 10,000 student engineers have been graduated from this course, and it is known wherever there are electrical engineers.

A course which combines practical test work with a study of electrical engineering is also maintained for high school graduates who, for one reason or another, are unable to attend college. This course requires five years, and, so far as purely technical training goes, offers an excellent curriculum. At present there are about 125 students in the course. It is being expanded rapidly, however.

A business training course open to college and high school graduates (three years for college graduates, five years for high school graduates) is also administered by the company. So far about 530 have been graduated from this course, in which such subjects as accounting, finance, industrial analysis and control, auditing and business law are taught.

Through arrangement with various educational institutions dozens of courses, ranging from business correspondence to the history of civilization and from machine tool operation to advanced engineering and the physical sciences, have been made available at a nominal cost. An aggregate of 5,500 are enrolled in these miscellaneous courses.

The company also administers a number of educational loan funds and scholarships. Such are the Charles P. Steinmetz scholarships, the Charles A. Coffin fellowships and the Gerard Swope loan fund. Within the last year a General Electric educational loan fund has also been established. The Charles A. Coffin fellowships are open to any student who wishes to pursue research work in any established institution of learning. The other scholarships and loan funds are open to General Electric employees or the children of General Electric employees. The scholarships and loans vary in amount.

Americanization work is also carried on in the various works of the company. Supplementing the formal educational work, the company maintains libraries in the larger plants. These libraries are primarily technical and are of course used a great deal in the work of the company. But employees are encouraged to use them freely for their own purposes as well. In a number of the plants arrangements have been made with the city library for the maintenance of a constantly renewed selection of the best in fiction and current popular works. The company recently inaugurated a plan whereby all day-rate and piece-rate employees of three years' service will receive one week's vacation with full pay and all employees of ten years' service two weeks with full pay.

Suggestion system proves benefits

The company maintains one of the most successful suggestion systems in the United States. Last year 18,077 suggestions were submitted by employees, of which approximately 6,000 were accepted. Awards totaled $56,000. These awards are on a strict percentage basis, according to the value of the suggestions. The largest award during the past year was for $1,200. The suggestion system serves as an excellent means of uncovering the more able factory men, and many have used it as the first step to more responsible positions.

In all of the works there are athletic associations, encouraged by the company but maintained entirely by the interest of the employees. These associations also plan entertainments, which are augmented by the various activities sponsored by the industrial service departments. In a number of the works there are recreational and club halls. In one plant a magnificent new building, containing bowling alleys, a billiard room, a large and completely equipped gymnasium and other facilities, was recently built to house recreational activities. The employees of this plant participated directly in the equipping of this building.

One Sale Electrifies the Home

Equipping the home piecemeal gives way to the electric home contract plan. Favorable terms offer incentive for group appliance purchasing plan

THOSE who are studying the merchandising problem in electrifying the home must have reached the conclusion that progress is not being made as rapidly as it should be. It is not because the public is not sold on the use of electric appliances in the home, but because there is too much competition for the consumer's dollar. The electrical dealer and central station have made it easy enough for the customer to purchase appliances one at a time, but the aggregate down payment and sum total of the monthly payments on several major appliances is so great that the customer cannot handle more than one at a time. This has resulted in restricted use of appliances and electrical energy.

If a man buys an electric range or refrigerator or vacuum cleaner or washer it is about all he can handle at one time, even with only 10 per cent down and twelve to eighteen months on the balance. What he usually does is to buy these major appliances one at a time. In the meantime the customer's real desire to have a complete electric home from the start has not been satisfied. The power company's end has not been accomplished because it desires all of the load or a major portion of it all at once so that it will derive the revenue. The apparent answer is for the central station and electrical dealer to do just what the furniture man does—permit the customer to buy for his entire needs at terms so attractive that the total amount of the contract is almost lost sight of. In other words, attractiveness of the terms has more to do with contract sales than does the total purchase price. Having these things in mind, the British Columbia Electric Railway Company, Ltd., Vancouver, B. C., has struck at the crux of the problem of electrifying the home with its "electric home contract" plan. The idea of group appliance selling is not entirely new or original, but the plan of making possible the purchase of *all* appliances for the home *under one long term contract with very low down payment* has not been used extensively, if at all.

The plan adopted by this company was put into effect June 18, 1929. Six crews of outside salesmen are operated in the Vancouver territory. Each crew specializes in one or two appliances, such as ranges, air heaters and water heaters; washers and ironers; vacuum cleaners and health motors, etc. The idea behind the group appliance plan is that if one of the salesmen calls on a lighting customer, he has an opportunity to talk complete electrification of the home instead of confining himself to his one specialty. He tries to interest the customer in buying a group of appliances rather than selling him first, say, a washing machine and then an ironing machine, and so on.

By spreading the payments over three years it is possible for a customer to buy four or five appliances for about the same monthly payments as the regular terms on a washing machine or range or other major appliance. Moreover, this plan meets the central station's real competitors, who are the radio dealer, the automobile salesman, the furniture man and others who also are striving for the consumer's dollar.

Typical Contracts Offer Basis for Rapid Cost Estimates

Method of Payment			Total Cost Over Three Years
A $500 contract	Down payment	$25.00	
	36 monthly payments of	14.90	$561.40
A $750 contract	Down payment	37.50	
	36 monthly payments of	22.30	840.30
A $1,000 contract	Down payment	50.00	
	36 monthly payments of	29.70	1,119.20
A $1,500 contract	Down payment	75.00	
	36 monthly payments of	44.60	1,680.60

Appliances have been arranged in two groups, class A and B. Class A appliances include electric range, refrigerator, air heater (3 kw.), electric ironer and clothes drier. Class B appliances include washing machine, dishwasher, floor polisher, water heater, vacuum cleaner, table appliances, kitchen heater, lighting fixtures and Telechron clock. The customer makes his selection, choosing at least two class A appliances. Inclusion of these two appliances and, providing the total amount of the contract is $500 or more, entitles the purchaser to the very liberal terms of the "electric home contract" plan. A down payment of 5 per cent is required and the balance is payable in 36 monthly installments with interest at 8 per cent on the balance outstanding at the end of each month.

For the convenience of salesmen in figuring the monthly payments a simple factor has been worked out. By multiplying the amount of the contract, after down payment has been deducted, by the factor of 3.126, the amount of the 36 monthly payments is ascertained. Some typical contracts are indicated in the accompanying table.

The usual amount of range and water heater wiring

. . . **"By spreading the payments over a three-year period, we make it possible for a customer to buy four or five appliances for about the same monthly payment as the regular terms on, say, a washing machine or a range, and we thought also that this plan would meet our real competitors, who are the piano salesman, the car salesman, the furniture man and others who are striving for the consumer's dollar. . . . I am convinced that we are proceeding along the right lines in endeavoring to sell a man an electric home instead of the odd appliance."**

EDMUND E. WALKER,
Sales Engineer
British Columbia Electric Railway Company, Ltd.

may be included in the group appliance contract, but where extra wiring is required the contract is approved by the company before it is signed by the customer, as it may be necessary to increase the down payment. The regular lien agreement form is used. Appliances sold on group contracts are sold at regular list prices and carry the full amount of profit.

In practice it has been found hard to get the rank and file of the specialty salesmen to interest themselves in the plan. Some of the older and more experienced salesmen, however, have written up some very good business on this plan, and aside from the actual group contracts obtained they have, in dozens of cases, worked the customer up from one appliance to two or three, which have been sold on the regular terms. The rest of the salesmen are beginning to see that there are great possibilities in pushing the plan. The number of group contracts taken up to the latter part of December was fifteen, amounting to $13,840, or an average of $920 each. Six of the contracts were cash.

Outside of mailing the group contract pamphlet to builders of new homes, practically no advertising was done during 1929, but it is planned to include an appropriation in the 1930 advertising budget and more actively push the plan.

The sales department of the company is enthusiastic over the plan and is convinced that it is proceeding along proper lines in electrifying the home as a unit instead of attempting to do it piecemeal by individual appliance sales.

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Better Apparatus Grounds for Safety and Service

THE grounding of the frames and neutral of energized apparatus as recommended in a recent report of the Engineering Section of the Southeastern Division, N.E.L.A., was described in the December 21, 1929, issue of the ELECTRICAL WORLD. Every piece of electrical equipment deserves adequate grounding in the interest of performance and safety.

Building Steel and Outdoor Structure.—In general the steel framework of a building or outdoor structure should be connected to the station or auxiliary ground bus by taps so located that as few mechanical joints as practicable will intervene between any part of the framework and a tap. Certain steel details, on account of their separation from live circuits, are not and obviously cannot become exposed to such circuits and be left ungrounded. All taps to steel work should be a minimum of No. 2/0 copper, made in accordance with grounding standards adopted by the company. All separate exposed parts should be grouped together and grounded through a tap of greater current capacity than the various parts.

Telephone Arresters.—Ground leads from these arresters should be connected usually to the auxiliary ground bus. Conditions occasionally arise, however, which require these to be treated differently, and in such cases the grounding should be the subject of special instructions on the drawings or in written specifications for the station.

Transmission Line Ground Wire.—The ground wire should preferably be carried overhead to the station and connected to the dead-end structure through a strain insulator. Just ahead of the insulator a tap made through an approved clamp should be taken down the structure and connected to the high-voltage lightning arrester ground electrode, since this overhead ground wire is subject to high-frequency current, similar to arresters. In other cases and if approved for the station in question, however, and if a ground wire naturally terminates at a thoroughly grounded steel structure or building framework, it may be connected thereto and considered as grounded.

Fences.—Sections of fences inclosing substations or lightning arresters, or which are otherwise exposed to contact with live circuits, should be bonded together and connected to ground rods with leads not smaller than No. 2 copper nor larger than No. 4/0. The ground rods should be ¾-in. copper coated, driven to a depth of 8 ft. beside each fence post, except those for arrester fences, in which case the fence should be connected to the arrester ground electrode.

Where wood posts are used the fence wire should be grounded every 50 ft. with No. 2 conductor or larger. The fence on each side of all gates or openings shall be grounded with the same size conductor as stipulated above. To prevent interruption of current flow when opening gates, the current path shall be made independent of the gates by bonding the fence wire on each side through a lead passing in the ground beneath the gate opening.

Switchboard, Instruments, Meters and Relays.—The ground bus for switchboards to which instruments, relay and meter grounds are made should be No. 1/0 copper, or equal, connected at both ends to the auxiliary ground bus. Instruments, meter and relay cables should be grounded with the same size conductor as used for the switchboard wiring. Taps to switchboard framework should be No. 4 copper and these taps should be so located that not more than three mechanical joints exist between any part of the framework and the tap.

Where power equipment, such as oil circuit breakers or main power circuits, are mounted on or near the switchboard, the tanks, frames and instrument transformer cases should be connected to the switchboard ground bus, which, in such event, should be of the size required for this equipment as determined by possible short-circuit currents.

Framework for supporting panels for d.c. railway circuits, operating with one power terminal grounded, should not be grounded, but should be insulated from ground. In this case the switchboard should be surrounded by an insulating platform in order to allow the operator to work on the panels safely under all circumstances.

Compensators and Controllers.—The minimum size ground tap for motor frames, or compensator and controller tanks or cases should be as follows:

Below 15 hp., No. 4 copper.
15 hp. to 200 hp., No. 1/0 copper.
200 hp. to 500 hp., No. 2/0 copper.
Above 500 hp., No. 4 copper.

For small equipment, protected by fuses or dependable relays, the ground taps should be in accordance with the requirements for similarly equipped industrial plants as follows:

Fuse not over 100 amp., No. 10 copper.
Fuse over 100 to 200 amp., No. 6 copper.
Fuse over 200 to 500 amp., No. 4 copper.
Fuse over 500 amp., No. 2 copper.

Conduits and Cable Sheaths.—All conduits or metal sheaths for control or power cables should be connected to the main or auxiliary ground bus. A pipe clamp on a clean surface may be used. A group of conduits or cable sheaths may be bonded together with a copper conductor and a single tap taken to the ground bus, such bonds and taps being made with No. 4 copper.

Lead sheaths for single-conductor cables carrying alternating currents should be grounded and insulated in accordance with special instructions given on the drawings or in written specifications, in order to avoid arrangements which will give rise to circulating currents in the sheaths. The minimum size ground conductor for lead cable sheaths should be No. 1/0 copper.

Miscellaneous.—Indoor bus supports, pipe or steel frame indoor structures, oil tanks, rails, etc., shall be grounded to the auxiliary ground bus or main ground bus with a No. 1/0 tap or larger. Ordinarily for indoor equipment a full size branch of the auxiliary ground bus should be run along the cell structures and taps made to this bus as required.

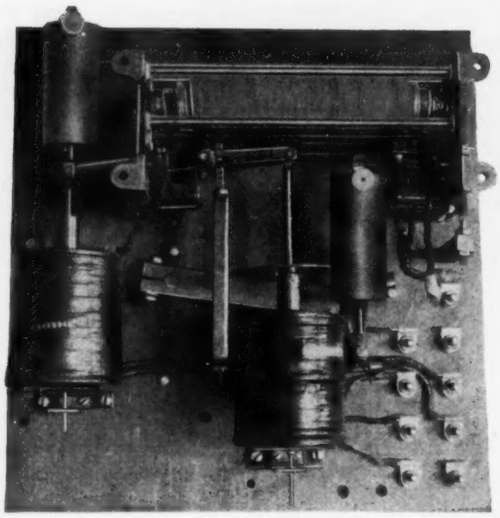
New Ideas for

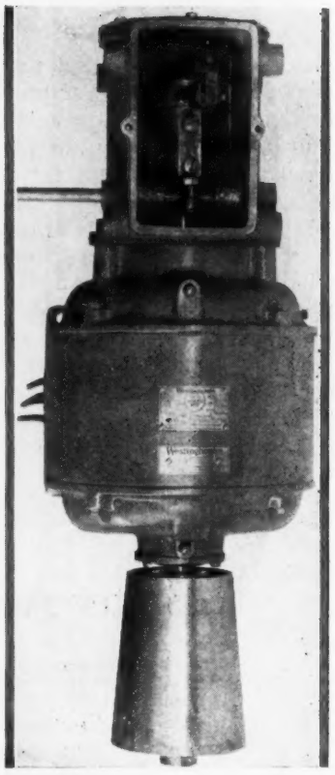
PAPER MILL ELECTRIFICATION

By S. A. STAEGE

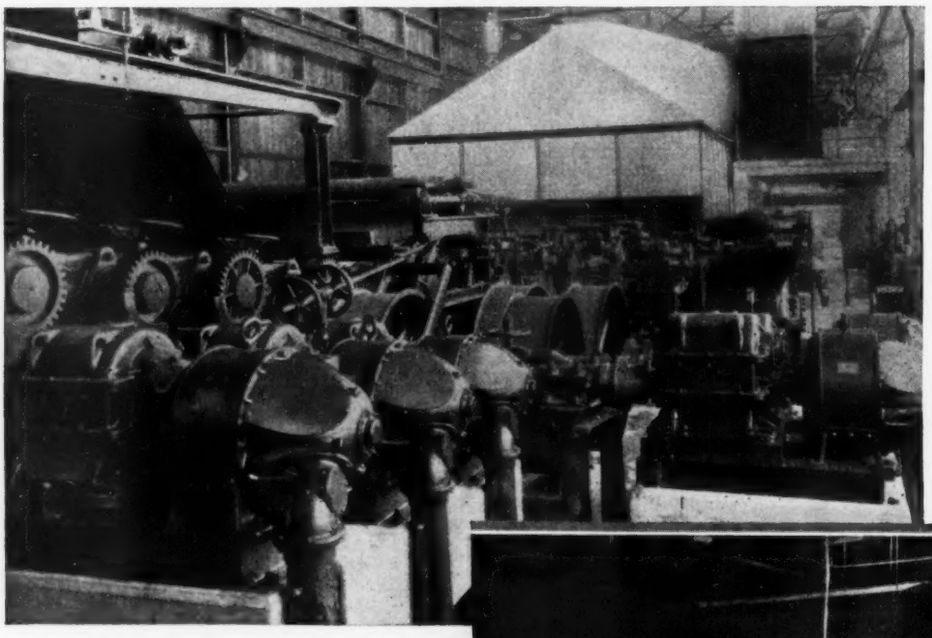
Paper Mill Engineer Westinghouse Electric & Manufacturing Company

RECENT contributions to the electrification of the paper industry include the perfecting of a carbon pile type of section speed regulator for paper machines, the use of multiple motor winder drive with generator braking and automatic tension regulation and the use of individual motors for each cylinder mold and primary press in addition to all the main sections with control at the wet end.

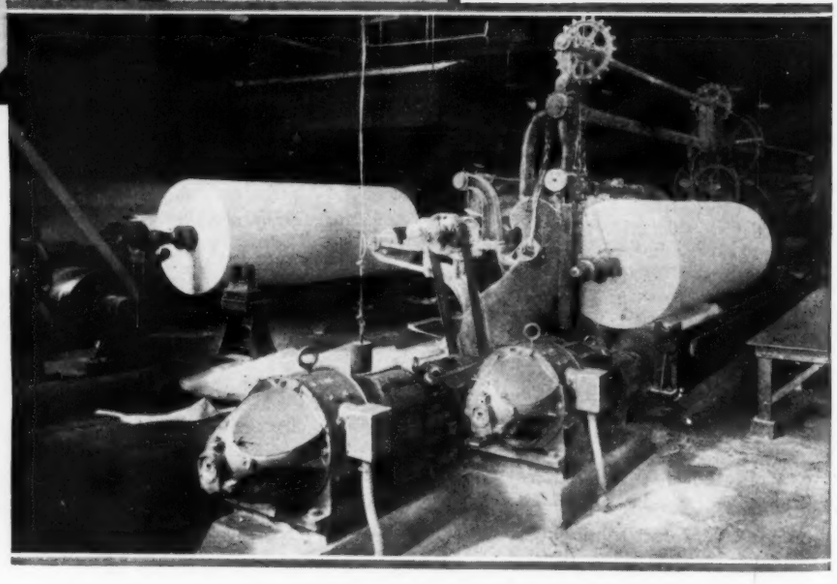




Section speed regulator with carbon pile control



Multiple motor winder drive with generator braking and automatic tension regulation at the St. Lawrence paper mills



Cylinder machine with individual Motor at the plant of the National Paper Products Company, Port Townsend, Wash.

Again—

The Franklin Specification

By E. D. TILLSON

Testing Engineer Commonwealth Edison Company, Chicago

LIGHTING is in a state of flux in all its applications. Admittedly it is inadequate and is not progressing as it should. One great difficulty is in the engineering of a good lighting installation. This ties into lighting specialists, architects and contractors and requires a high degree of technical and practical expertness.

THIS ARTICLE by Mr. Tillson is a discussion of the industry lighting problem and of the development of the Franklin specification as an agency to bring about progress in better lighting.

DURING the last two years the Franklin "red seal" specification has aroused considerable comment in the trade press, mostly favorable, but partly otherwise. It now seems desirable that some person, in part responsible for the specification and with its success at heart, should review the circumstances which led up to its formation and explain its use.

A mere handful, we might say, of lighting men the country over have used the utilization coefficient method of determining outlet spacing and lamp size. This method is somewhat involved and tedious. It requires calculation and more or less expert handling, which probably accounts for its limited use.

On the other hand, we have the great mass of architects, engineers, contractors and utility men who must, almost daily, decide on these things. What system or method of calculation do they use?

To answer the question it is only necessary to take some recent plans of almost any average architect, consulting engineer or contractor and look them over. We urge everyone interested in good lighting to do so.

Present lighting practice

In general, we find that in the case of the regulation multi-floor loft or industrial building there is shown one outlet per bay and at the center of the bay, these bays being from 16 to 22 ft. square and with a ceiling height between 11 and 12 ft. The capacity per outlet ordinarily specified is 150 or 200 watts. We have even seen 55 watts specified, although the 16-cp. carbon lamp, which consumed 55 watts, has been extinct for almost twenty years.

A very simple solution, obviously, and one which appears beautifully symmetrical on the plans. But how about results? Under the most favorable conditions 200 watts on 16-ft. centers with RLM reflectors will furnish an approximate *average* value of 5 foot-candles, but under actual shop conditions and with the usual obstructions only from a few hundredths of one foot-candle up to possibly three or four, whereas the great bulk of industrial operations today call for from 10 to 50 foot-candles actual.

We know of no manufacturer of lighting equipment, whether intended for industrial or commercial use, who recommends that his reflectors be hung on a spacing-mounting ratio of over 1½ to 1 (as an extreme), and yet with one outlet per bay we may easily have a ratio of over 2½ to 1.

Similarly with office buildings. The structural bays ordinarily run from 16 to 17 ft. wide (in a direction parallel to outer or court walls) and from 24 to 26 ft. deep. Such bays are commonly subdivided into two 8x12-ft. private offices and a reception room 12 ft. x 16 ft. or thereabouts. A usual layout, we regret to say, is two 150- or 200-watt outlets per bay, or an outlet spacing of 12x16 (or 17) ft., for an open floor. If the bay is subdivided as mentioned, an extension is run each way from the front outlet, making three outlets per bay. Some layout men, with more than ordinary liberal minds, provide three outlets at the start and a few have even been known to provide four.

What happens with such spacings and wattages? In the case of an open floor and ideal conditions 200 watts on a 12 ft. x 16 ft. spacing, and with suitable office luminaires, would provide an average of 4 foot-candles. If the bays are completely subdivided this would drop to probably less than 2 foot-candles, whereas it is pretty well established that clerical work requires from 10 to 15 foot-candles and drafting work from 15 to 25 foot-candles.

And so we might go through the list of industrial and commercial structures, clubs, banks, public buildings and churches and fine extremely wide spacing, minimum wattages, extensive working spaces between the walls and the first row of outlets, etc.

What happens after these buildings are turned over to their owners? Take an industrial plant, for example. Except in rare cases the headroom is quickly cluttered with pipes, ducts, line and counter shafts, pulleys, belts, belt shifters, shaft hangers, motors and motor platforms.

To get underneath at least some of these obstructions the overhead lighting is lowered to 8 or 9 ft. from the floor, thus making a bad condition worse. The mechanics soon discover that they cannot do fine machine work with a 200-watt lamp 10 ft. or more away and located behind their backs, their arms and bodies shadowing the work.

Local machine lighting a compromise

In every case of this kind, sooner or later, the owner or lessee is driven to local machine lights entirely (which is a throwback to Mediævalism) or he must quadruple the outlets on the ceiling. Time after time these owners call upon the utility or on the contractor to help them out in their distress. The lighting man arrives on the job and discovers that in order to provide proper illumination the entire building must be rewired, and at a cost which is staggering alike to the owner and to himself. If it were merely a matter of changing the lamp and reflector size or the type of luminaire this would be easily accomplished. The well-being of the employees would be conserved, the morale and the output of the place revived and both the contractor and utility would do a profitable stroke of business. But under the circumstances usually nothing is done, and as far as the lighting is concerned the plant is a disgrace to every one.

Similarly with office buildings. Completion of the building is usually the signal for rewiring the structure on the installment plan. Many monumental office buildings, whose exteriors delight the eye but whose interiors are wired to about the same adequacy as was current ten to fifteen years ago, require the most expensive additions to the wiring before the plaster is scarcely dry. Specific instances of this could be quoted one after another.

Take the case of railway terminals. In one metropolitan area with six large railway terminals, one of them built within the last five years, there is not a place in all of these vast waiting rooms where a person can read newsprint with comfort, the measured illuminating at many points being one-half of 1 foot-candle. And so we might go on to list the failures to illuminate large buildings, which failures the electrical men cannot very well fasten on any one outside of their own ranks, as the initiative for improvement must surely come from them, if from any one.

It was to help correct the above situation that the Franklin specification was designed. Essentially it is the coefficient of utilization method worked backward and tabulated in such a manner that the user can determine outlet spacing and lamp size without calculation. Furthermore, in the average case and with limited practice, one can obtain both simultaneously.

Franklin specification not inflexible

The Franklin specification is prefaced with a table of foot-candle values suitable for quite a number of interiors and operations, both industrial and commercial; also, there is some explanation of the use of the specification and its terms. Assume that the person who desires to use the specification knows the foot-candle value that he wants, the ceiling height and general condition of the room, and the type of equipment, when he turns to the main table of the specification and picks out that particular foot-candle value. Immediately above at the top of the column is the lamp size and directly across to the left is the outlet spacing required. We cannot imagine anything more expeditious, and so far as accuracy is concerned, continued use by many lighting men has proved that it is about as accurate as the coefficient of utilization method. At least it is several thousand per cent more accurate than putting an outlet at the center of every building bay.

Some one might question our assumption that the person using this specification knows the room conditions, type of equipment he intends to use, etc., but examination of the Franklin specification will show that these items are grouped and illustrated so plainly that there is small chance of going wrong, even for one relatively unfamiliar with the subject, while in the case of a layout man with any degree of experience, he instinctively turns to the main table, and with these factors familiar to him from the start, he immediately obtains the lamp size and the spacing that he requires. We know that this is so because in the writer's own company, for example, where there is a lighting layout man for each district of the city, these men, who formerly labored with the coefficient of utilization method, now use the Franklin specification entirely and with real success in the manner just outlined. It saves a great amount of labor and time. Furthermore, it means that many small jobs which formerly were more or less guessed at because of the crowd of work now have the Franklin specification method applied to them. The same result has been called attention to by lighting men in other cities.

In the ELECTRICAL WORLD of November 23, 1929, is an article by Mr. Cravath, which brings up still another phase of the subject. He expresses the thought that the architect or builder does not know at the time that the building plans are drawn just what the occupancy of the building will be, and because of this and the rush of work in an architect's office at such a time he is disinclined to make any complete outlet plan, rather, providing for merely a definite load in watts per square foot throughout the building. His thought, which is the same as that of the California Electrical Bureau, which is sponsoring the California "red seal" plan for industrial and commercial buildings, is that if we set up a standard of watts per square foot for all such buildings the lighting will be more or less automatically taken care of.

I agree that most architects in making preliminary

estimates for the cost of a building use the watts per square foot standard to arrive at the total capacity of the service, of the switchboard and other elements of wiring up through the building, but sooner or later, whether they are rushed or not, they must and do make a complete layout of the outlets. Either they must do it or they must turn it over to some contractor to do.

For the purposes of preliminary estimates I believe that a standard of watts per square foot for all types of buildings is highly desirable and should be encouraged by the electrical industry, but I do not believe that it will be easy to raise the standard of watts per square foot from the 1, 1½ and 2 figures which architects are now using up to 3, 4 and 5 watts per square foot which are demanded by the rapidly increasing use and diversity of applications of electric light. The N.E.L.A. and S.E.D. committees which are working on this problem realize this difficulty. They propose to express the capacity in square feet per circuit. It is sincerely hoped that some such standard of wiring adequacy will be completely worked out and become an effective instrument in the industry, operating in the same manner as the "red seal" plan for residences.

Architects must be convinced

But the difficulty still remains how to convince the architect that these high (to them) watts per square foot or the equivalent are necessary. The Franklin specification purports to do this. It shows that in order to get the foot-candle values necessary for various operations we must have certain outlet spacings and certain capacities per outlet which can easily be converted to watts per square foot by mental arithmetic.

The case is analogous to that of a man building a home. With the advice of the contractor, perhaps, he has settled in his own mind a fixture cost of, say, $300. Immediately thereafter he comes into contact with a fixture manufacturer who tells him in a positive way that he should spend $1,000 for his fixtures and then leaves him. Is it likely that this man will raise his "ante" $700 on the mere statement of the fixture manufacturer? We think not. But if this same manufacturer were to explain all the reasons for his stand, mentioning the greater durability, the better appearance, the more classic design, the clearer detail, etc., involved in the higher-priced fixtures he might gain his point.

I do not agree that the architect or builder is ignorant of type of occupancy of a given building. The type of building, its location, the classes of business carried on in the neighborhood and many other things determine the type of occupant in advance. Many buildings are erected with the chief occupants already signed up or as part owners of the building. For example, certain well-defined parts of a business district are favorable to the location of professional offices; others to brokers and commission men; others to small retail and beauty shops, etc. All this is quite well known in advance.

Another important point is that even 5 watts per square foot wiring capacity in a commercial structure does not constitute or even indicate a well-lighted building. The writer was recently called in to review plans emanating from a prominent firm of consulting engineers. The headroom of the floors in question was 9 ft. 10 in. The layout man had located 1,000-watt outlets on this ceiling! The spacing was 12 ft. x 16½ ft. His thought, obviously, was that a high value of watts per square foot was the one desideratum.

I am convinced that the Franklin specification fills a definite need, and I know from experience that it is workable and has been the means of raising the standard of lighting and wiring in many buildings. I also believe that standard wiring specifications are needed, but that such need not be combined with the Franklin specification or replace it. There is need for both. One of the difficulties we have had is to prevent those with perfectly good intentions from adding material to the Franklin specification. My thought is that that this specification should remain as concise and simple as it is possible to make it. If it were possible to put it all on one page it would be much better than it is now. The more pages we add to it the less likelihood there is of this being universally used.

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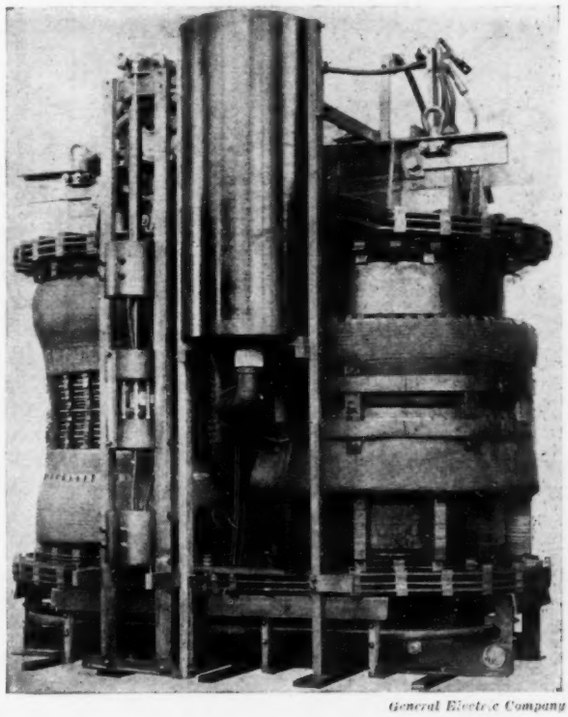
Non-Resonating Transformers Have Low Internal Stresses



General Electric Company

AMONG the engineering developments of 1929 was the non-resonating transformer. Lightning or switching disturbances may cause high-frequency oscillations which produce localized stresses in the ordinary transformer, but which are uniformly distributed in this 28,866-kva. unit. The 220-kv. high side is shown. Metallic shields outside the coils supply the capacitance charging currents, avoiding charging currents from coils to ground passing through the inductance of the coils, so that the voltage drop across the coils is a constant independent of frequency.

TESTING

Network Relays

By CARL W. EVANS

Underground Distribution Engineer
San Antonio Public Service Company

THE proper functioning of a low-voltage secondary unfused network system ultimately depends upon the proper operation of the automatic relays. The importance of acceptance and routine tests upon these relays cannot be overestimated.

WHILE it is possible to test the proper functioning of all mechanical operations of a network system protector in the field by manually closing or opening relay contacts, testing and adjusting of the electrical characteristics of the relays is a problem for the laboratory or test room.

DUPLICATION of field conditions in the testing and adjustment of relays to optimum characteristics is permitted in the meter and relay laboratory of the San Antonio Public Service Company. The testing panel was designed for the mounting of one particular type of "phasing" and "closing" relay. Relays of the same general type but of different manufacture may be easily tested by means of adapting plugs and cords.

All of the equipment is mounted and wired directly upon the panel with the exception of the resistance bank, which is mounted separately but in such manner that the operator has convenient access to the 2,000-ohm variable resistor.

The design of this panel is such that only one relay at a time may be tested, either a "phasing" or "closing" relay. The relay is mounted on the proper terminal block and after a general inspection for loose connections, burned contacts, or broken parts, the test proper is made and the relay is adjusted to the characteristics standardized by the company.

The testing of a "closing" relay consists of the following routine:

(a) Investigation and adjustment of spring tension.

(b) Test and adjustment for overpotential closing.

(c) Test and adjustment for reverse current tripping.

The actual details relating to the adjustment of the relays are found well described in the manufacturers bulletins and instruction books, but in order to correlate such information with the particular test panel under discussion a few remarks on the actual test procedure may not be out of order here.

In making the test and adjustment for overpotential closing switches S_{11}, S_{12} and S_{15} are closed, the latter to the right-hand position facing the front of the panel. Closing switch S_{12} gives proper connection for adjusting the A-phase element of the closing relay. The switches S_1 to S_9 are then operated, together with the variable rheostat, in such a manner that the current passing through the air core reactor, the impedance ohms of which are known, is varied until a value is obtained that will give a voltage drop of 2 volts across the reactor. The shading coil of the A-phase element is then adjusted until this potential will just cause the closing contacts to complete the circuit through the red indicating lamp. As a check upon the adjustment the current is then decreased until a voltage of 1.5 volts results across the reactor terminals, in which case the closing contacts should remain open. Switch S_{12} is then opened and switch S_{13} is closed, which prepared the circuits for the adjustment of the B-phase element. In a manner similar to the above, the B-phase element adjustment is completed and the process is extended to the C-phase element by opening switch S_{13} and closing switch S_{14}.

Test for reverse current

With the relay thus adjusted for overpotential closing, the test is concluded by adjusting for reverse current tripping. In this test switches S_{11}, S_{12}, S_{13}, S_{14} and S_{15} should all be closed, the latter, however, being in the left-hand position this time. This connection energizes all elements of the relay and completes a circuit from the resistance bank through the primary of the current transformers, the connections of which are such that the currents in the secondary circuits passing through the relay

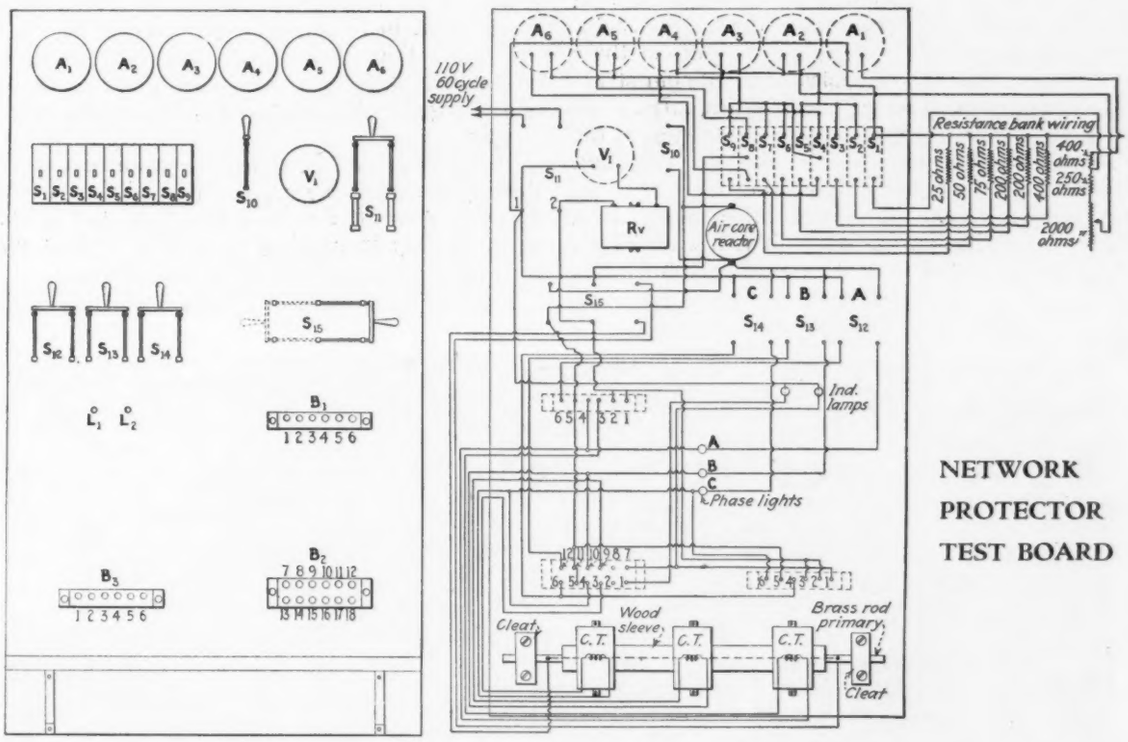
elements are 180 deg. out of phase with the potential impressed upon the relay elements. The value of the current in the current transformer primary circuit is then adjusted to the value of reverse current upon which the relay is to close its tripping contacts. The San Antonio company has adopted a value of 6 amp. as the minimum of transformer exciting current upon which a relay will be required to function. Having adjusted the current to the proper value, the tripping contact is adjusted for that particular value of reverse current. The proper adjustment is checked by decreasing the current and then gradually increasing it until the value of 6 amp. is obtained, at which time the relay, if properly adjusted, will close its tripping contacts, which in turn complete the circuit through the green indicating lamp, informing the tester that the relay has functioned properly.

Phasing relay test is simple

The testing and adjusting of a "phasing" relay is a more simple process than that just described, inasmuch as the relay consists of only one element and has only one adjustment, that of overpotential closing. To make this test the relay is mounted upon the terminal block and switches S_{11}, S_{14} and S_{15} are closed, the latter again to the right-hand position. With the adjustable shading coil at the extreme right end of its travel, the current through the air-core reactor is adjusted until the relay just closes its contacts. This value of current when multiplied by the impedance of the reactor gives the maximum phasing voltage for which the relay may be adjusted and should be at least 2 volts. If this value of voltage is very nearly 2 volts, proceed with the test by opening switch S_{15}, which removes the resistance bank load current from the reactor circuit and closes the reactor short-circuiting switch S_{10}. With this arrangement there is zero volts across the phasing circuit of the relay, under which condition the shading coil is to be moved slowly to the left until the relay just closes its contacts. If the adjustment is correct, the opening of switch S_{14} should cause the contacts to open, while the reclosing of switch S_{14} should cause the contacts to just close.

Adjusting the relay in the manner just described gives it a closing characteristic on a phasing voltage of very nearly zero volts and also insures that the contacts will remain closed as long as the network protector is closed and carrying load. This method of adjustment has been found quite satisfactory in the network system operated by this company, but the characteristics of some network systems are such that better operation is obtained when the "phasing" relay is adjusted to close its contacts on some positive value of phasing voltage leading the network voltage. In such cases the procedure to be followed is exactly as in the adjustment of one element of the "closing" relay for overpotential closing.

It was the experience of this company to have a large number of network relays in service previous to the time



NETWORK PROTECTOR TEST BOARD

A_1—Ammeter, 0-0.2 amp. A_2—Ammeter, 0-0.5 amp.
A_3—Ammeter, 0-1 amp. A_4—Ammeter, 0-2 amp.
A_5—Ammeter, 0-5 amp. A_6—Ammeter, 0-10 amp.

S_1, S_2, S_3, S_5, S_6, S_7, S_9—S.P.S.T. toggle switches.
S_4, S_8—S.P.D.T. toggle switches.
S_{10}—S.P.S.T. unfused, 30-amp. knife switch.
S_{11}—D.P.S.T. fused, 30-amp. knife switch.
S_{12}, S_{13}, S_{14}—D.P.S.T. unfused, 30-amp. knife switch.
S_{15}—D.P.D.T. unfused, 30-amp. knife switch.

V_1—Voltmeter, 0-150 volts.
L_1, L_2—Small switchboard type lamps, red and green.
B_1, B_2, B_3—Relay mounting terminal blocks.

In addition to the above, there are required an air-core reactor of an impedance approximating 8 ohms, three phasing lamps and sockets, three current transformers of types used in protector units, fixed resistors of 25, 50, 75, 200, 250 and 400 ohms, and a variable resistance of about 2,000 ohms.

of the completion of the relay testing panel. The beneficial effect of submitting the relays to test and adjustment has therefore been quite apparent. Excessive operation of protectors, with resulting closing motor and trip coil failures; failure to open on reverse or fault current and similar troubles, have been eliminated almost entirely.

Perhaps the most significant fact relative to the usefulness of the panel is that only three cases of network protector trouble have been reported since its installation. Of these three one was a hot lug connection and the two others minor adjustment troubles in the closing mechanism.

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10-Ton Crane Built of Aluminum Alloy

By F. V. HARTMAN and E. C. HARTMANN
Physical Testing Division, Aluminum Research Laboratories, Aluminum Company of America

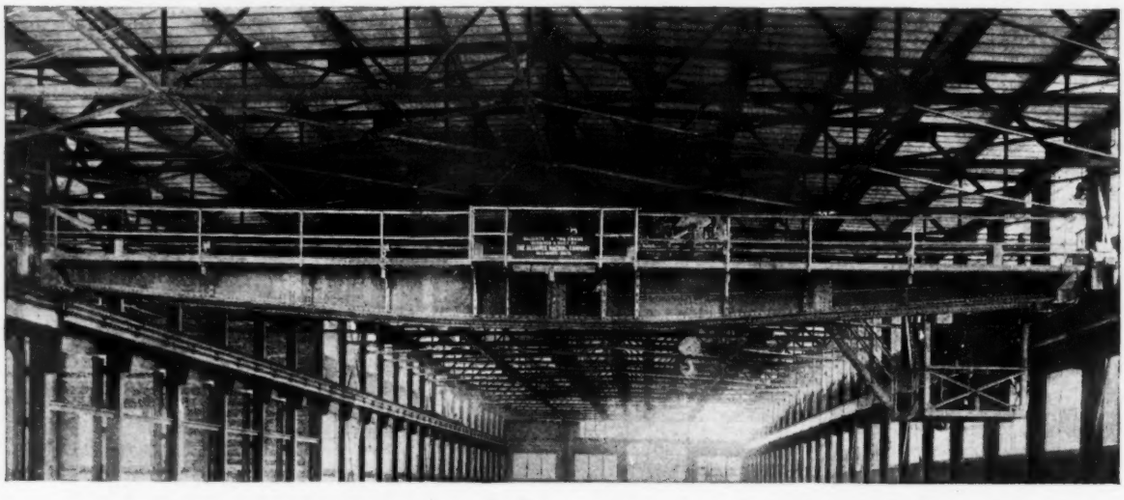
A NEW and interesting example of the application of the strong alloys of aluminum in the field of structural engineering is found in the 10-ton traveling crane recently installed in the works of the United States Aluminum Company at Massena, N. Y. While there have been numerous other examples of aluminum structures in the past, such as motor truck bodies, large shipping and storage containers, railway cars, etc., this is the largest structural application today with the exception of the framework for lighter-than-air craft.

Briefly described, the aluminum alloy crane is a three-motor, single-hook machine with a lift of 22 ft. The bridge is fabricated from two double web girders spaced 7 ft. on centers. The girders are constructed of the strong aluminum alloys and have a span of 72 ft. 2 in. Aluminum was also used in the walkway, handrails and operator's cage. The bridge girders frame into cast steel carriages at their ends and a one-piece cast-steel trolley carrying the hoisting mechanism is mounted on the girder rails. A total of 12 tons was saved in the crane as compared to a steel crane.

The modulus of elasticity of aluminum is only about one-third that of steel. Because of this difference in the modulus of elasticity an aluminum girder, having a cross-section identical to that of a steel girder, would deflect about three times as much under load and have less lateral stiffness. Since this is the case, it was necessary to construct the girders of the aluminum alloy crane with sections somewhat deeper, wider and greater in area. In addition to this, the girders were given approximately twice as much camber as would ordinarily be used in a similar steel girder.

The aluminum alloy crane was built by the Alliance Machine Company, Alliance, Ohio. Although this company had had no previous experience with aluminum alloys, it encountered no fabrication difficulties. The web and cover plates were flattened and sheared on the same equipment ordinarily used in the construction of steel girders. The rivet holes were sub-punched and then reamed to size in the usual manner. Hot steel rivets, $\frac{3}{4}$ in. in diameter, were used throughout. They were driven with air-operated squeeze riveters, except for some of the more inaccessible ones, which were driven with pneumatic hammers. No difficulty was experienced in riveting the girders, although a few special precautions were taken. For instance, excessive rivet temperatures were avoided to decrease the possibility of heating the aluminum plates sufficiently to draw their temper.

In addition to this, the rivets were driven at random during the assembly of the box girders in order not to concentrate the heating effect of the rivets and in order to help in keeping the girder straight during the riveting.



THIS 10-TON TRAVELING CRANE WAS BUILT OF ALUMINUM ALLOY

Interplant Feeders Utilize Catenary Suspension

By J. A. COOK
Superintendent Electric Department,
Lynn (Mass.) Gas & Electric Company

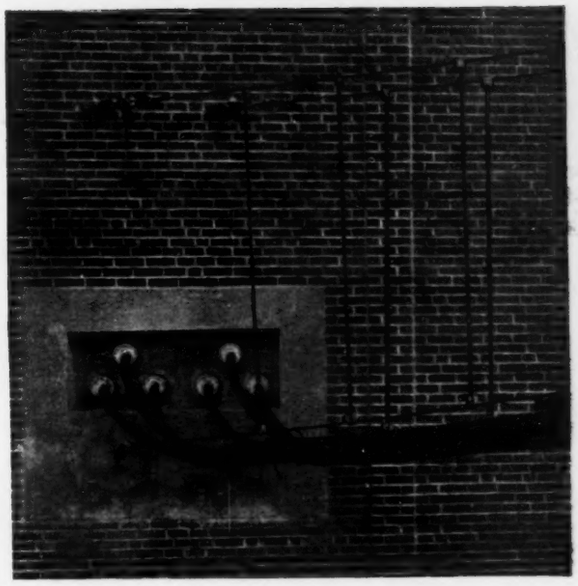
TO INSURE continuous electrical energy supply to the gas manufacturing plant of this company duplicate three-phase cables have been installed between the generating station service buses on the premises and the major load center of the gas works. In 1929

Catenary span provides excellent alignment and accessibility for interbuilding cables

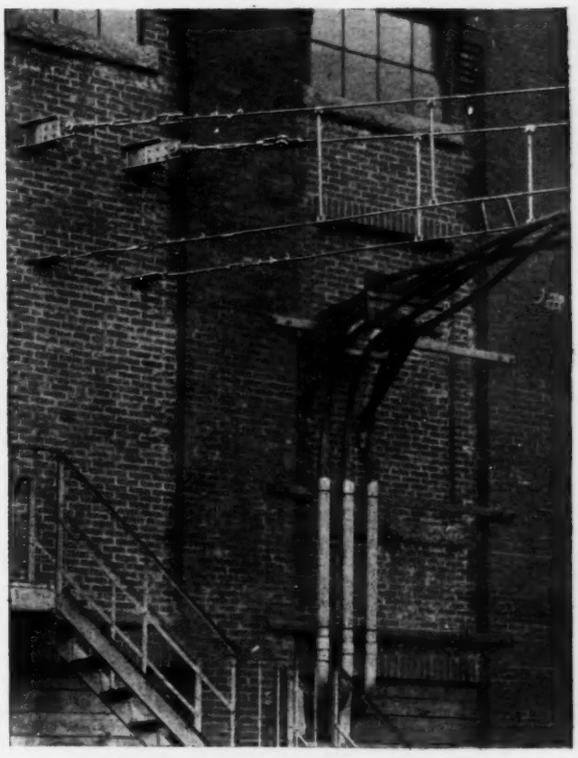
the company entered upon a program of completely replacing the steam-driven equipment of its gas plant with motor-driven units. The load totals 1,200 kva. and either feeder circuit is capable of supplying the entire requirements, automatic transfer of load being provided for in case of interruption on the preferred feeder. The principal distributing center for the gas works is 125 ft. distant from the nearest generating plant switch house wall. There are many subsurface structures on this property and construction developments frequently require excavation work. The soil contains chemical residues from the gas works processes which expose the sheaths of lead-covered cables to some

Make-up of Catenary Span

Length of span, feet	131
No. of circuits	2
No. of power cables	6
Size of each cable, circ.mil	800,000
Type of cable	Stranded; tape and seine twine braid
Insulating wall thickness, in.	5/32
Manufacturer of cable	Kerite Company
Catenary wire	
Material, extra heavy copperweld, in.	5/8
Tensile strength, lb.	28,980
Working stress, lb. at 65 deg. F.	10,000
Messenger wire identical with catenary design	
Suspender wires, galvanized iron straps, in.	¼x1¼
Attachment	By 1-bolt clips
Feeder cable supports	In 6½-in. Bonita cable rings, special triangular shape



Close-up of catenary span take-off from switch house



Detail of span terminus at load center

hazard. For these reasons it was decided to run the supply cables overhead and on account of the distance and cable size involved it was determined to employ catenary suspension, an arrangement equally applicable to general industrial plant exterior wiring practice. The scheme has been applied on this property to various subsidiary cable feeds besides that illustrated.

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Frictional Electrification of Gasoline

CONDITIONS surrounding the occasional disastrous explosions and fires apparently originating in the passage of gasoline from a truck to a storage tank have usually suggested as a satisfactory explanation the generation of static charge, resulting difference of potential, and spark discharge. The phenomenon was new, however, in that a liquid was involved. The familiar examples of the generation of static electricity by friction are those pertaining to solids in the insulating class. In the case of gasoline we have a liquid passing usually over a metal, or at times over an insulator as represented by a rubber tube.

The question has been studied in great detail as reported in a recent series of articles in the *Revue Générale de l'Electricité*, and several important influences on the magnitude of the static potentials generated have been uncovered. It is found, for example, that the electric conductivity of the liquid plays a most important part. If the gasoline or other hydrocarbon is in a highly insulating condition, the frictional effect is very small. As the conductivity increases the frictional charge generated increases up to a certain conductivity, but beyond that it decreases rapidly, there being a critical conductivity for which the static generated is a maximum. The actual value of this maximum is also related to the velocity and the sectional area of the passage. The effect is increased by passing the liquid through the filings of certain metals, and it is reduced virtually to zero by the filings of certain other metals. In extreme cases potential differences as high as 30,000 volts were measured.

Of special interest are the studies which were made on the conductivity of hydrocarbons in films of the order of 0.01 mm. thickness. In the low range of stress these films show the familiar high insulating properties. At increasing stress the conductivity appears to be unstable, having intermittent periods of high conductivity and reversion to the insulating stage. In a third phase, however, at stresses of the order of 100 kv. per centimeter, the liquids have become highly conducting, approaching the behavior of metals in this regard. This conductivity is not a breakdown, as there is no evidence of spark and the liquid is restored to its original condition on removal of stress.

It is to this highly conducting phase pertaining to thin films that the author attributes the efficiency of metal filings in increasing the charges generated by friction. The highly conducting power of thin films would seem to have special interest and importance in connection with the use of impregnated paper as high-voltage insulation. The oil between the layers of paper occurs in just such thin films as are reported in these experiments.

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Electric Water Pumping Calculations Simplified

By W. PARKERSON
General Commercial Manager
Public Service Company of Oklahoma, Tulsa, Okla.

TO DETERMINE rapidly and easily the probable cost of water pumping, electrically, the Public Service Company of Oklahoma has developed a chart which combines the factors of total dynamic head in feet, and in pounds per square inch, over-all efficiency, cost of energy requirement per 1,000 gal., and cost per 1,000 gal. The graphic solution is of course applicable to any large-volume water pumping operation, although devised primarily for city water works problems.

The example illustrated by the dotted line in the accompanying figure shows that if a motor-driven pump is operating against a total dynamic head of 325 ft. or its

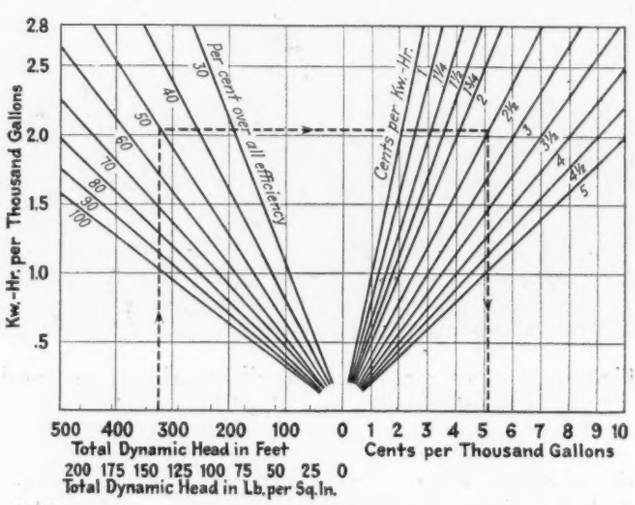

Chart speeds estimating of electric water pumping costs

equivalent, 140 lb. per square inch, and the over-all efficiency of the pump and motor combined is 50 per cent, then the energy required would be 2.04 kw.-hr. per 1,000 gal., and if the average rate charged for energy is 2½ cents per kilowatt-hour the cost of pumping water will be 5.1 cents per 1,000 gal. pumped.

This graph may be used in various ways. For example, if, from operating data, it appears that 2.04 kw.-hr. may have been used per 1,000 gal. pumped, and it is known that the total dynamic head against which the pump operates is 325 ft., then the over-all efficiency of the installation will be seen to be 50 per cent. The chart has proved highly useful in keeping our local managers in touch with city water pumping conditions.

Men of the Industry

S. P. MacFadden Assumes New Duties in Boston

S. P. MacFadden, formerly vice-president and general manager of the Western Public Service Company, Scottsbluff, Neb., has just been named assistant to the president of the Engineers Public Service Company with headquarters in Boston. Both these properties are under the executive management of Stone & Webster. Mr. MacFadden has been connected with the Nebraska utility since 1925, when

he was appointed manager of the northern division. Upon the reorganization of the company in 1929 he was elected vice-president.

It was in 1917 that Mr. MacFadden first entered the employ of Stone & Webster at Beaumont, Tex., in the distribution department. After discharge from military service he returned to Beaumont, but subsequently was assigned to new duties in Houston and later at Port Arthur. For some years he has been active in the Nebraska section of the National Electric Light Association.

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Frederick A. Baker, for the past nine years in the New London division of the Connecticut Power Company, has resigned the post of general superintendent to go to the Union Electric Light & Power Company, Unionville, Conn., where he will report directly to the president and treasurer of the latter organization. The Union company is owned by the Connecticut Power Company. Mr. Baker was formerly in the employ of Stone & Webster, Boston, and has been active in civic affairs in the New London district. With Mr. Baker's resignation the office of general superintendent of the New London district has been abolished.

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M. L. Evans New Vice-President of Ohio Utility

At the recent annual meeting of shareholders and directors of the Columbus (Ohio) Railway, Power & Light Company Morgan L. Evans was elected vice-president in charge of operations. Mr. Evans has been with the Columbus company practically all his life. After leaving high school he entered the accounting division of the company, working through all the departments of that division. In 1917 he took charge of the stores, holding this position until 1919, when he was made purchasing agent. He served in this capacity until 1925, when he was transferred to the security division. In 1927 he was made assistant superintendent of the company, and two years later, in May, 1929, he was made superintendent. Mr. Evans has been a director of the company since July 1, 1929.

William A. Wolls was elected vice-president in charge of the company's commercial business. Mr. Wolls also is a member of the board of directors.

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Ralph Miller, for several years past sales manager of the Cambridge (Mass.) Electric Light Company, has been appointed general manager of the Cape & Vineyard Electric Company, with headquarters at Hyannis, Mass.

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G. E. Whittlesey, who has been superintendent of distribution for the Pittsfield Electric Company, Pittsfield, Mass., has been transferred to the engineering department of the Western Massachusetts Companies, with offices in Pittsfield. Lawrence D. Bigelow, who has been superintendent of underground wires for the United Electric Light Company of Springfield, has succeeded to the position in Pittsfield formerly held by Mr. Whittlesey.

D. C. Green Vice-President Electric Bond & Share Company

D. C. Green, who relinquished his duties as vice-president and general manager of the Utah Power & Light Company more than a year ago to associate himself with the New York office of the Electric Bond & Share Company, has been elected a vice-president of Electric Bond & Share. Mr. Green has a broad background of experience in public utility work and has been a prominent figure in the electric light

and power field for a number of years. His earliest connection in the electrical industry was with the Allis-Chalmers Company, but he left the manufacturing branch to join the San Diego Consolidated Gas & Electric Company.

During his association with the Byllesby interests he held executive positions at Albany and Marshfield, Ore.; Everett, Wash., and Fort Smith, Ark. From 1923 to 1929 he served as vice-president and general manager of the Utah Power & Light Company, an Electric Bond & Share subsidiary.

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Ralph Steffens has been appointed manager of the Electric Association of Chicago to succeed R. Bourke Corcoran, whose resignation was announced in the March 1 issue of the Electrical World. Mr. Steffens is a graduate of the University of Chicago

with a Ph.D. degree in economics. In preparation for his master's degree he remained at the university for a time and took post-graduate work, specializing in finance. His first connection was with the Harris Trust & Savings Bank of Chicago, where he was employed in the general banking department. He went then to the Northern Trust Company in 1927 in the credit division of that organization.

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HAROLD H. BODGE, whose appointment as commercial manager of the Fall River (Mass.) Electric Light Company was recently noted in the ELECTRICAL WORLD, has been transferred to the Boston office of the parent company, the New England Power Association. In his new position he will be occupied in co-ordinating the sales activities of the retail distributing companies of the association.

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ALTON T. LITTLEFIELD has been appointed director of public relations of the Central Maine Power Company, taking on this work in addition to his present duties as head of the public information department. COLONEL F. H. FARNUM, formerly in charge of public relations work for the Central Maine company, relinquished this position in order to devote more time to broader responsibilities.

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H. HOBART PORTER, president of the American Water Works & Electric Company, has been re-elected chairman of the Engineering Foundation, research organization of the national societies of electrical, civil, mining and metallurgical and mechanical engineers. Otis E. Hovey and G. N. Clevenger were elected vice-chairmen of the foundation. Gano Dunn and George L. Knight were named additional members of the executive committee. Alfred D. Flinn was re-elected director and secretary.

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WILLIAM P. CREAGER, chief engineer of the Power Corporation of New York and vice-president of the Northern New York Utilities, Inc., sailed from New York March 8 en route for Russia, where he will act as consulting engineer for the Soviet government of Russia on its $50,000,000 hydro-electric development and navigation project. Mr. Creager will represent the J. G. White Engineering Corporation of New York, with which he was associated for seventeen years before becoming identified with the up-state properties. He is considered an authority on hydro-electric development and has written several books on the subject. Mr. Creager has arranged for a leave of absence from his duties with the Power Corporation of New York and the Northern New York Utilities. He will be away about two months.

J. W. Barker New Dean of Engineering at Columbia

JOSEPH W. BARKER, who was appointed dean of the faculty of engineering of Columbia University, as announced in the March 8 issue of the ELECTRICAL WORLD, has had a very colorful career, embracing extensive military experience as well as academic activities. A native of Lawrence, Mass., and a graduate of the University of Chicago, Mr. Barker entered the Coast Artillery Corps, U. S. Army, in 1916, and from that date he remained in military service until he resigned his commission less than five years ago. His assignments took him to Virginia, Oklahoma, to France with

the American Expeditionary Forces and to Germany, where he spent four years with the American forces. When he returned to America he became identified with the Coast Artillery School, Fort Monroe, Va., but in 1924 he was detailed for graduate work at the Massachusetts Institute of Technology and the following year he resigned his commission in the U. S. Army to accept appointment as associate professor of electrical engineering at M.I.T. In 1929 he was appointed professor of electrical engineering, head of the department of electrical engineering, and director of the curriculum in electrical engineering at Lehigh University, the office he occupied at the time of his recent appointment to the faculty of Columbia University.

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CHESTER A. DAVIS, vice-president of the New York Power & Light Corporation, has resigned to become an executive of the General Management Corporation of New York. Mr. Davis was president and general manager of the Cohoes Power & Light Company until the acquisition of that company in 1927 by the New York Power & Light Corporation. He entered the new organization and had been in charge of realty matters for it. Mr. Davis entered the power field in 1901 with the Dayton (Ohio) Power & Light Corporation, going in 1907 to the Marlborough Electric Company in Massachusetts, whence he went to Cohoes in 1918 as vice-president and associate general manager of the Cohoes company.

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OBITUARY

MALCOLM H. HENDEE, 51, commercial manager of the Augusta division of the Georgia Power Company, died suddenly at his home in that city March 5. Mr. Hendee entered the employ of the Augusta-Aiken Railway & Electric Corporation in the summer of 1908 as chief clerk to the vice-president and the general manager and in 1911 was promoted to the new-business and merchandising department as manager. In the summer of 1919 the stores and purchasing department was added to his responsibilities. Later he was relieved of the duties of purchasing agent and made assistant secretary and treasurer, in charge of the accounting department, and also continued the duties of commercial manager. In the fall of 1928 the Augusta-Aiken Railway & Electric Corporation was absorbed by the Georgia Power Company and Mr. Hendee was placed in charge of commercial activities in the Augusta division.

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GUY STERLING, who since 1900 has carried on a private practice in general engineering with headquarters in Salt Lake City, Utah, died in that city February 23 of pneumonia at the age of 70. Following his graduation from Cornell University in 1887 with a degree in civil engineering, he specialized in electrical engineering at Lewis Institute, Chicago, and then joined the Union Pacific Railroad in survey work in California. Subsequently he worked with the U. S. Geological Survey in California and Idaho, the Idaho Mining & Irrigation Company and the North Pacific, Yakima & Kittitas Irrigation Company of Washington. His private practice included hydraulics, construction, power, mining, geology, litigation in mining and water rights, extended surveys and reports on the Green River in Utah and investigations and investment reports on irrigation and power projects in the Western states for J. G. White & Company.

Financial and Statistical News

DESPITE market inactivity, the averages of representative groups of utility common stocks are again over twenty times earnings. A representative group of holding company stocks averages 21 times earnings and an operating group average ratio stands at approximately twenty.

——THERE IS EVIDENCE THAT THE PUBLIC is getting into the market in a larger way. Until recently it was whispered that 60 to 75 per cent of trading was professional. Current increase in odd lot trading would indicate growing public participation.

——THERE ARE STILL MERGERS IN PROCESS in the utility field, but much more caution is apparently used in their promotion.

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New York Peak 1,225,200 Kw.

THE GENERATING STATION net output of electric energy in 1929 of the New York Edison Company and associated companies was 11.1 per cent greater than the output for the preceding year.

The 1929 output amounted to 4,679,000,000 kw.-hr.; that for 1928 was 4,211,000,000 kw.-hr. The actual increase was therefore 468,000,000 kw.-hr.

The 1929 instantaneous peak load for the system of five companies, which means the maximum demand for current at any moment during the year, was 1,225,200 kw., or nearly 7 per cent greater than the peak for 1928, which was 1,146,128 kw. The 1929 peak occurred at 5 p.m. December 17; the peak for 1928 was at 5 p.m. December 20. The 1929 peak of 1,225,200 kw. was equivalent to 1,642,360 hp.

Westinghouse Makes No Plan to Retire Stock

F. A. MERRICK, president of the Westinghouse Electric & Manufacturing Company, stated that while the matter of the retirement of the preferred stock of the company has received some informal consideration by the officers, no plan of retirement has been considered by the board of directors, nor is it contemplated to submit a plan of retirement to the stockholders at their meeting on April 9, 1930.

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Moderate Rise in January Output

ELECTRICAL ENERGY OUTPUT of all public utilities, including electric railway plants, in January exceeded that of December by 1.5 per cent, and that of the preceding January by 5 per cent, the total being 8,647,373,000 kw.-hr. After

CURRENT EARNINGS REPORTS OF ELECTRIC LIGHT AND POWER COMPANIES

	1929	1928	Per Cent Increase	Operating Ratio 1929	Operating Ratio 1928
Central Illinois Light					
(Year ended December 31)					
Gross earnings	$5,136,159	$4,765,845	7.8	58	59
Net earnings	2,160,350	1,948,715	10.9	..	..
Cities Service					
(Year ended Jan. 31, 1930)					
Gross earnings	46,795,692	35,242,133	32.7	..	..
Net earnings	45,413,729	34,076,346	33.2	..	..
Columbia Gas & Electric & Subs.					
(Year ended December 31)					
Gross earnings	115,150,313	107,195,658	7.4	49	49
Net earnings	58,320,101	54,264,393	7.5	..	..
Consumer Power					
(Year ended December 31)					
Gross earnings	33,420,539	30,464,127	9.7	48	49
Net earnings	17,200,462	15,430,231	11.5	..	..
Detroit Edison					
(Year ended December 31)					
Gross earnings	56,558,279	52,366,335	8.0	66	65
Net earnings	18,978,304	18,264,814	3.9	..	..
Eastern Texas Electric & subs.					
(Year ended January 31)					
Gross earnings	9,872,530	8,133,440	21.3	..	..
Net earnings	4,125,490	3,324,868	24.1	..	..
Eastern Utilities Associates					
(Year ended January 31)					
Gross earnings	9,357,883	8,646,498	8.2	..	..
Net earnings	3,750,313	3,267,651	14.8	..	..
Federal Light & Traction & subs.					
(Year ended December 31, 1930)					
Gross earnings	8,515,666	7,912,158	7.6	57	57
Net earnings	3,456,378	3,225,442	7.2	..	..
Galveston-Houston Electric & subs.					
(Year ended January 31)					
Gross earnings	5,228,610	5,254,430	—0.5	..	..
Net earnings	1,698,568	1,706,082	—0.4	..	..
Kansas City Power & Light					
(Year ended December 31)					
Gross earnings	$14,582,846	$13,749,850	6.1	50	51
Net earnings	7,195,156	6,745,784	6.7	..	..
Kansas City Power & Light					
(Year ended January 31, 1930)					
Gross earnings	14,591,622	13,835,214	5.5	50	51
Net earnings	7,228,929	6,783,400	6.6	..	..
National Power & Light & subs.					
(Year ended December 31)					
Gross earnings	80,979,244	79,259,372	2.1	55	55
Net earnings	36,307,951	35,166,488	3.2	..	..
New York Power & Light					
(Year ended January 31, 1930)					
Gross earnings	22,463,619	20,603,807	9.0	58	57
Net earnings	9,305,269	8,944,698	4.0	..	..
North American & subs.					
(Year ended December 31)					
Gross earnings	147,779,869	135,551,899	9.0	52	53
Net earnings	71,328,275	64,399,252	10.8	..	..
Puget Sound Power & Light & subs.					
(Year ended January 31, 1930)					
Gross earnings	16,499,557	15,247,323	8.2	..	..
Net earnings	6,572,606	6,626,872	—0.8	..	..
Southern California Edison					
(Year ended December 31)					
Gross earnings	40,325,465	35,281,927	14.0	33	33
Net earnings	27,127,177	23,486,981	15.0	..	..
Tennessee Electric Power & subs.					
(Year ended December 31)					
Gross earnings	14,752,228	13,453,842	9.6	51	52
Net earnings	7,262,828	6,488,490	11.9	..	..
Virginia Electric & Power & subs.					
(Year ended January 31, 1930)					
Gross earnings	17,140,844	16,297,227	5.2	..	..
Net earnings	7,794,767	7,092,016	9.9	..	..

the decrease in November, the average daily output is again rising, but has not yet equaled last October's peak. In that month the total output was 8,708,000,000 kw.-hr.

The monthly production of electricity by the use of water power, after having been less than in each of the last seven corresponding months of the previous year, was 7 per cent greater in January, having risen 5 per cent compared with December.

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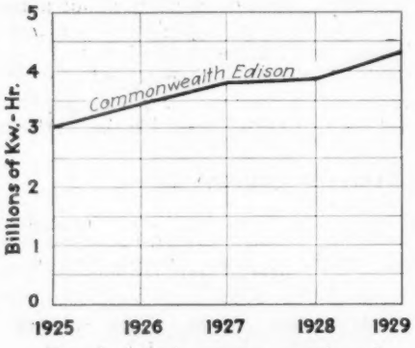
Prosperous Year Reported by Insull Companies in Middle West

ANNUAL reports recently issued by some of the Insull properties in the Middle West covering the year 1929 indicate that operating conditions in that section of the country were favorable, these companies showing increases in gross revenue ranging from 6 to 13.4 per cent.

Gross operating revenues of the Commonwealth Edison Company for the fiscal year ended December 31, 1929, were $83,486,745, an increase of $6,443,969 over the operating revenues for the fiscal year of 1928. The report shows



Total electric output produced and purchased

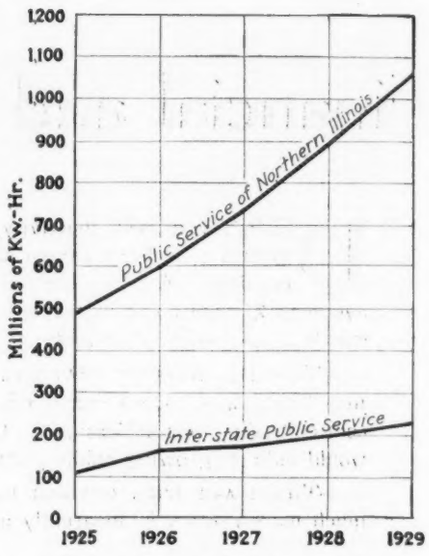
that the net sum available for dividends, after payment of all operating expenses and interest on funded debt, was $16,322,769, an increase of $847,660 over 1928, notwithstanding the fact that rate reductions effective in 1929 reduced the company's revenues by $1,344,580.

For the first time in its history the company on November 29, 1929, reached a maximum load of more than 1,000,000 kw. (1,000,200 kw. being the actual maximum, compared to a maximum of 980,000 kw. for 1928). The company increased its annual load factor in 1929 to 51 per cent, as against 48.7 for 1928, which means an increased output per unit of capacity.

Operating revenues of the Public Service Company of Northern Illinois for the year 1929 were $33,329,811, an increase of $3,813,541, or 12.9 per cent, compared with the year 1928. The number of customers increased 21,611 over the number in 1928, or from 416,317 to 437,928. Of this sum the electric customers numbered at the close of 1929 282,438.

The Central Illinois Public Service Company reported gross earnings, including merchandise sales, for the year 1929 amounting to $15,218,444. This compared with $14,345,999 for the year 1928, showing an increase of $872,444. During the year the aggregate power loads of the company, including those added through the acquisition of new properties and purchased companies, increased 22,169 kw. and the aggregate lighting loads increased in this period 7,360 kw. The total number of customers served by the company, including those added through acquisition of new properties and purchased companies, increased by 5,314 during the year.

Increased volume in all branches of the company's business and further economies in production and general operations were reported by the Illinois Northern Utilities Company, resulting in a substantial improvement in net income over 1928. Gross earnings for the year 1929 amounted to $3,836,876, a gain of 9.7 per cent over the gross earnings for the year 1928. The total output of electricity for the year 1929 was 80,829,297 kw.-hr., as compared with 76,107,220 in 1928.



Sales of electricity since 1925

Operating revenue of the Interstate Public Service Company for the year ended December 31, 1929, was $10,417,475, compared with $9,825,894, an increase of 6.02 per cent, according to the annual report of the company. Sales of electrical energy in 1929 totaled 226,852,808 kw.-hr., compared with 199,740,766 kw.-hr. in 1928, and total number of electric customers on December 31, 1929, was 97,430, compared with 93,721.

Operating revenue of the Indiana Service Corporation, a subsidiary of the Midland United Company, for the year 1929 was $5,114,671, compared with $4,508,445 in 1928.

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NEW CAPITAL ISSUES

AMERICAN COMMONWEALTHS POWER CORPORATION made an offering of 6 per cent convertible gold debentures at $98.16 and accrued interest to yield 6.25 per cent, a piece of financing involving a total of $10,000,000. Proceeds will be used to retire $3,436,500 of convertible gold debentures due 1949, bank indebtedness and other corporate purposes.

Another convertible issue was offered by United American Utilities in the form of ten-year 6 per cent convertible gold bonds, series A, priced at 98 and accrued interest to yield over 6.25 per cent. Proceeds from the sale of these bonds and the class A stock is to be used for the acquisition of properties and additional securities, to reimburse the corporation for such expenditures, and for other corporate purposes.

Earnings of Insull Companies Show Marked Gain

	Gross Earnings 1929	Gross Earnings 1928	Per Cent Increase	Net Earnings 1929	Net Earnings 1928	Per Cent Increase	Operating Ratio (1929)
Commonwealth Edison	$83,486,745	$77,042,776	8.3	$31,805,691	$30,606,184	3.9	62
Public Service Company of Northern Illinois	33,329,811	29,516,270	12.9	12,965,337	12,194,572	6.3	61
Central Illinois Public Service	15,218,444	14,345,999	6.1	5,619,203	5,150,222	9.1	63
Illinois Northern Utilities	3,836,876	3,497,479	9.7	1,626,971	1,421,248	14.4	57
Interstate Public Service	10,417,475	9,825,894	6.0	4,397,993	4,065,315	8.2	58
Indiana Service	5,114,671	4,508,446	13.4	1,833,846	1,546,572	18.7	64

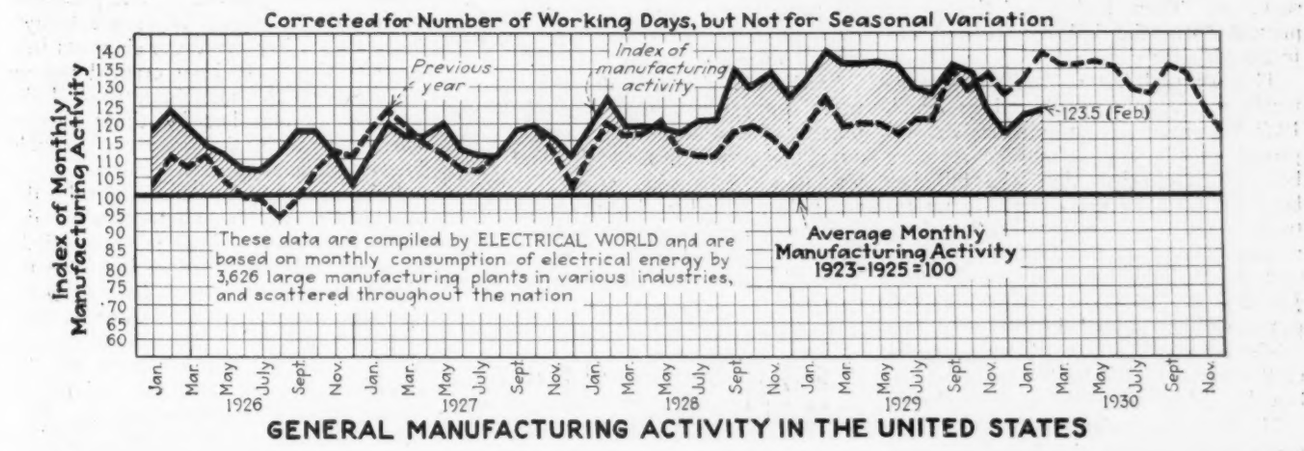
(Middle West Utilities Company report not yet received).

Slight Increase in General Manufacturing Operations

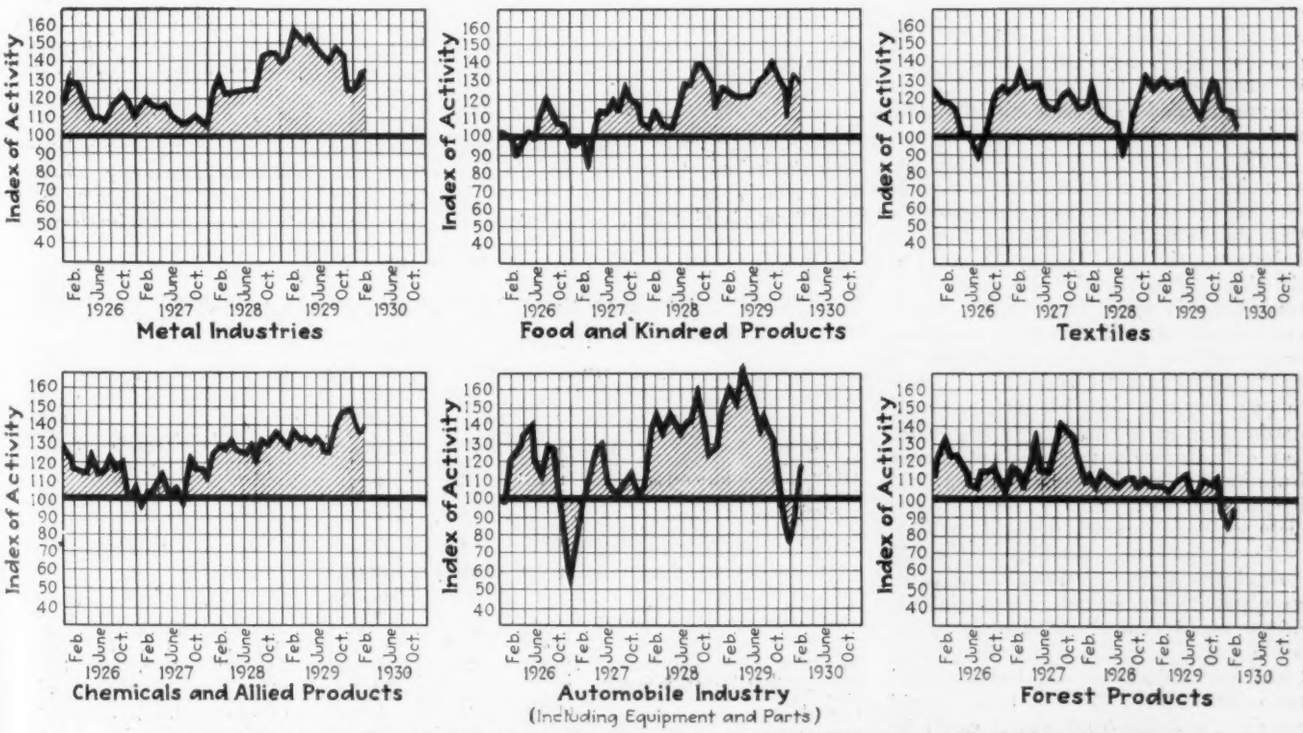
FEBRUARY witnessed a slight increase in the rate of general manufacturing activity as compared with that reported for January, gaged by the consumption of electrical energy by about 3,800 manufacturing plants reporting to the ELECTRICAL WORLD. The increase, however, amounted to only 1.4 per cent, materially under that normally witnessed during this season of the year. Seven industrial groups reported increases over January, as follows: Ferrous and nonferrous metal working plants, 3 per cent; lumber and its products, 8.2 per cent; automobiles and accessories, 17.0 per cent; paper and pulp, 14.2 per cent; rubber products, 28.4 per cent; chemicals and chemical products, 2.1 per cent; and shipbuilding, 0.8 per cent. On the other hand, four important manufacturing groups reported a decrease in rate of operations as compared with January, as follows: Leather products, 6.3 per cent; textiles, 8.1 per cent; stone, clay and glass, 6.0 per cent, and food products, 2.3 per cent. The rolling mills and steel plants reported the same rate of operations as for January.

Compared with February, 1929, manufacturing in general reported a rate of activity about 12 per cent lower. All but five groups reported a material drop, the four industries reporting increases being paper and pulp, 9.8 per cent; rubber products, 19.8 per cent; chemicals and chemical products, 0.6 per cent; food products, 1.3 per cent, and shipbuilding, 31.4 per cent.

The manufacturing groups reporting a decreased rate of operations as compared with February last year are as follows: Rolling mills and steel plants, 12.4 per cent; ferrous and nonferrous metal-working plants, 15.1 per cent; leather products, 15.3 per cent; textiles, 22.3 per cent; lumber products, 12 per cent; automobiles and accessories, 27.8 per cent, and stone, clay and glass, 21.5 per cent. The average rate of general manufacturing for the first two months of the current year is 10.1 per cent under the same period last year.


Corrected for Number of Working Days, but Not for Seasonal Variation
Index of Monthly Manufacturing Activity
Previous year
Index of manufacturing activity
123.5 (Feb)
These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,626 large manufacturing plants in various industries, and scattered throughout the nation
Average Monthly Manufacturing Activity 1923-1925=100
1926
1927
1928
1929
1930

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES



ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

Business News and Markets

N.E.M.A. Does Not Approve Amended Kelly-Capper Bill

THE Kelly-Capper bill as now amended has, after careful study, been disapproved by the law committee and the board of governors of the National Electrical Manufacturers' Association. These bodies feel that in its present form the bill has certain objectionable features.

The original bill on maintenance of resale prices as first offered in April, 1929, was investigated and received approval of the law committee and the board. Since that time the bill has been amended by the committee on interstate and foreign commerce, to which it was referred by the House of Representatives. That committee reported on January 27, 1930, recommending the passage of the amended bill.

The reasons given for the disapproval of the amended bill by the association's board and law committee are as follows:

"1. The Kelly-Capper bill was formally approved by the board of governors because it intended to provide, and did provide, for complete resale price maintenance; that is, from manufacturer to the ultimate seller to the consumer, and was concerned solely with resale price maintenance.

"The present Kelly-Capper bill, as amended by the committee on interstate and foreign commerce, does not provide that the manufacturer can by contract enforce resale price maintenance up to the last seller to the consumer. It provides only for a contract for resale price maintenance between the manufacturer and the first person to whom he sells. The person to whom he sells may in turn contract with his purchaser for resale price maintenance, but any seller can only contract with the purchaser from him. The net result of this would be in the electrical business, where distribution is through jobbers and then dealers, that the manufacturer could compel the jobber to resell at a price stipulated by the manufacturer, and the jobber could compel his dealers to resell at a price stipulated by the jobber, but the manufacturer could not control the resale price which the jobber could stipulate, and the result might easily be that jobbers selling the same line of goods would stipulate different resale prices for the dealer.

"2. Sec. 2 of the bill as amended is ambiguous in that it is not clear whether any one selling for resale at retail in the same city or town must sell at the same price to every purchaser regardless of quantity.

"3. Sec. 2 also provides that a contract for price maintenance shall not prevent the selling at other than the stipulated price toward the end of a season of a surplus stock of goods specially adapted to that season. There is too much indefiniteness in the phrases 'toward the end of the season' and 'specially adapted to that season.' "

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Key to Successful Sales Held by Buyer

CLOSE COMMUNION with the buyer of industrial products in his native haunts and product psychoanalysis were cited as two important means of solving the present-day marketing problems of American industry by Edward J. Mehren, vice-president of the McGraw-Hill Publishing Company, Inc., speaking recently at a dinner held at the Blackstone Hotel, Chicago, in connection with an Industrial Marketing Conference under the auspices of the American Management Association. He cited the buyer as the agency from whom the manufacturer with red ink or falling sales in his merchandising picture can learn the path to successful sales. Mr. Mehren said in part:

"Everything in successful marketing today focuses on the product. All of the 'back-of-the-product' insurance of plant personnel and production goes for naught if the product be not possessed of today's features. What are today's features? They are those elements in a product that have been created not on the basis of the manufacturer and the producer alone, but by those factors operating with the greatest possible knowledge of the user's needs.

"The day of inclusion of the sales department's contribution to product development work is here more definitely than ever before. It often has been included in previous times, but rarely on the basis that today's conditions necessitate such inclusion. The competition of today outstrips the salesmen of the cloistered product, and the tool of research stands ready to relieve these over burdened sales forces. . . . Construction may be pushed, agriculture may be relieved and mining may be helped, but the manufacturing industry of America can help itself. While differing in detail, the merchandising problems of industry are much the same in principle. Merchandising or marketing puts the spotlight on many of our troubles classed under headings such as engineering, finance, overproduction and

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DELINQUENT ELECTRICAL ACCOUNTS

(National Electrical Credit Association)

NUMBER OF ACCOUNTS REPORTED

Division	January 1929	January 1930	Per Cent Increase or Decrease	Twelve Months 1928–29	Twelve Months 1929–30	Per Cent Increase or Decrease
New York	198	308	+55.5	3,312	3,128	—5.6
Middle and Southern Atlantic	134	236	+76.1	2,177	2,047	—6.0
New England	111	107	— 3.6	1,607	1,505	—6.3
Central	594	835	+40.6	8,560	8,106	—5.3
Total	1,037	1,486	+43.3	15,656	14,786	—5.6

TOTAL AMOUNTS REPORTED

	January 1929	January 1930	Per Cent Increase or Decrease	Twelve Months 1928–29	Twelve Months 1929–30	Per Cent Increase or Decrease
New York	$36,930	$73,342	+98.6	$496,980	$690,576	+39.0
Middle and Southern Atlantic	14,836	34,232	+130.7	281,195	280,013	— 0.4
New England	10,925	22,008	+101.4	198,795	222,251	+11.8
Central	61,980	110,846	+78.8	1,001,041	1,003,079	—0.8
Total	$124,671	$240,428	+92.8	$1,988,011	$2,195,919	+10.5

others. Overproduction is too easy with an obsolete product, and overproduction is the result, not the cause, in many a case.

"Around the corner in industrial marketing there lies intensive study of products and lines from the customer's angle, supplemented by resulting developments in marketing, sales cost accounting, sales control and sales promotion analysis."

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Metal Market Unchanged

	March 5, 1930 Cents per Pound	March 12, 1930 Cents per Pound
Copper, electrolytic	18	18
Lead, Am. S. & R. price	6	5¾
Antimony	8¾	8¾
Nickel, ingot	35	35
Zinc, spots	5.35	5.30
Tin, straits	36¼	36¼
Aluminum, 99 per cent	24.30	24.30

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Management, Equipment Meetings in Chicago

WASTE ELIMINATION IN INDUSTRY featured the National Management Congress which was held in Chicago during the week of March 3, coincident with the national meeting of the materials-handling division of the American Society of Mechanical Engineers and the first Industrial Marketing Conference of that division of the American Management Association.

An extensive exhibition of products and equipment in the three classifications of management, materials handling and plant service provided a contact with the physical materials of these activities which did much to heighten the interest of all the meetings. Other special matters treated in the Management Congress were progress in distribution methods, simplification and mechanization in the administrative field, plant maintenance, wage incentive plans and managerial education and training sessions. On the last subject an interesting paper was one by W. T. Galloway of the Middle West Utilities Company, who spoke on how one public utility corporation trains its managers, bringing out the fact that the principal part of such training must be by exposure to the spirit of an organization and the methods by which it solves its managerial problems.

Of especial interest to the electrical engineer in industry was the excellent series of papers on materials handling, through practically all of which ran the continuous thread of electrical drive and control. This feature was also apparent in the exhibition in that many of the equipments and devices on display depended for their operation and control on electrical energy.

TRADE BRIEFS

Trumbull Electric Manufacturing Company will move its New York office from 114 Liberty Street to Lincoln Building, 60 East 42d Street, about March 10.

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National Lumber & Creosoting Company has appointed Leonard Perez district sales manager in St. Louis district. For several years Mr. Perez has handled various matters pertaining to production, purchase and treatment of timber products for the Missouri Pacific Railroad.

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Cutler-Hammer, Inc., has appointed M. C. Steffen manager of the Cincinnati office to succeed R. I. Maujer, resigned. For the past five years Mr. Steffen has been associated with the company's St. Louis office.

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Westinghouse Sales Billed Up 14.45 per Cent

DESPITE general business recession in the final quarter of 1929, the earnings statement of Westinghouse Electric & Manufacturing Company shows new records for the year in several directions. Sales billed increased 14.45 per cent to $216,364,588. Net manufacturing profit was up 20.95 per cent. Gross income from all sources increased 22.3 per cent and net income available for dividends was up 30.01 per cent. The volume of unfilled orders as of January 1 was $62,025,399, approximately $15,000,000 in excess of the value of unfilled orders January 1, 1929.

Total current assets are more than six times the total of current liabilities which represent the entire indebtedness of the company. Fixed assets representing factories, warehouses, etc., show only a small net increase during the year and no major extensions or additions are contemplated for 1930.

Surplus shows an increase for the year of $29,729,690. The balance, $13,994,747, of the total increase in surplus represents the net gain from the sale of additional common stock at a premium, the proceeds from which sale were used to redeem the outstanding issue of $30,000,000 bonds called for redemption March 1, 1929. Capital stock is now the only capital liability.

Developments in radio field

The company has been co-operating with the officers of associated companies in the radio field with a view to unifying the manufacture and sale of radio receiving sets in one company. As a result R.C.A. Victor Company, Inc., was incorporated to take over certain properties and assets, the principal manufacturing plants being located at Camden, N. J. Also in order to unify the manufacture and sale of radio tubes the R.C.A. Radiotron Company was formed to take over certain assets related to the manufacture of these products. The parent company will this year undertake the marketing of Westinghouse radio receiving sets manufactured for it by the R.C.A. Victor Company, Inc. During the year the company also participated in the financing of General Motors Radio Corporation, and Westinghouse Electric Elevator Company acquired Norton-Blair-Douglass, Inc., manufacturer of electric signal systems, etc.

The year's growth shown by the company is illustrated by the statistics shown in the following table:

	1929	1928
Sales billed	$216,364,588	$189,050,302
Sales costs	194,371,987	170,867,970
Net manufactured profit	$21,992,601	$18,182,332
Net income available for dividends	$27,062,611	$20,814,940

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Electric Industrial Trucks and Tractors

JANUARY SHIPMENTS of electric industrial trucks and tractors as reported to the Department of Commerce by the ten leading manufacturers in the industry were 139, as compared with 151 in December and 152 in January, 1929.

Shipments of Electric Industrial Trucks and Tractors

(In number of vehicles)

		— Shipments —	
1929	Total	Domestic	Export
January	152	133	19
February	134	131	3
March	211	201	10
April	194	181	13
May	211	202	9
June	201	185	16
July	168	163	5
August	154	144	10
September	158	151	7
October	167	134	33
November	118	110	8
December	151	124	27
Total (year)	2,019	1,859	160
1930			
January	139	123	16

Market Conditions

EQUIPMENT business in most sections of the country may be characterized as satisfactory, but by no means exceptional. The Eastern, Southeast and New England districts report volume of sales unchanged from the recent trend.

——MIDDLE WEST AND SOUTHWEST BUSINESS from power companies reflects spring construction work.

——MARCH BUSINESS ON THE PACIFIC COAST receded both in power and industrial equipment.

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PACIFIC COAST

—BUSINESS IN ALL *electrical branches has slumped perceptibly during March. This is particularly true of contracting, where most of the jobs are from steady customers with few jobs reported for general bidding.*

Prospective building, however, includes a $1,000,000 Masonic building for Los Angeles, a $1,000,000 home for retired church workers in Los Angeles, a $1,300,000 unit for Stanford Hospital, (the first of a projected $6,000,000 expenditure), a projected $5,000,000 addition for Los Angeles General Hospital, a $2,000,000 Ford plant for Seattle and such power construction projects as a two-year program of $1,300,000 for a Los Angeles street railway and a $150,000 power line for the Prescott (Ariz.) district. Power orders have included $50,000 Westinghouse reactors, $25,000 distributing transformers, $45,000 feeder regulators and $25,000 circuit breakers, all for Los Angeles. The outstanding order for the past week covers four 4,000-kva. General Electric transformers, value $70,000, for Benicia. Industrial motor sales are slow, government buying includes power and intercommunicating cable for San Diego barracks, an electric furnace for San Diego shops and a turbine pump and motor for Fort Barry. The electrical contract, value $75,000, for the Long Beach auditorium has just been awarded.

Awards for machinery and apparatus announced in Seattle and Puget Sound district include two waterwheels with rated capacity of 91,000 hp., with a 95,000 maximum, by the city of Seattle for the Diablo project to the S. Morgan Smith Company for $648,550; sixteen steel towers to carry high-tension lines from Ruskin hydro-electric project in British Columbia to Stewart & Barber, Vancouver, B. C., for $72,500, and intake gate at Bridge River tunnel to Vancouver Engineering Works for $32,000. General Electric Company secured award for furnishing four high-speed elevators, motors, etc., costing $100,000 for medical and dental tower in Tacoma and the Pacific Electric & Manufacturing Company sold one 73- and two 15-kv. oil circuit breakers and $2,500 worth of miscellaneous switchgear. Bids of 18⅛ cents per foot for furnishing 13,000 ft. of parking cable for an ornamental street-lighting system were received by the city of Tacoma, and the General Electric Company, bidding $5,243 and $4,552, submitted the only bids to Tacoma for two rectifiers and 67 luminous arc lamps, respectively.

CONSTRUCTION PROJECTS

San Joaquin Light & Power Corporation, Fresno, Calif., is having plans drawn for a steam-operated electric power plant to cost $3,000,000. Bend, Ore., plans ornamental lighting system. Western States Plate Glass Company, care of H. L. Dixon & Company, Pittsburgh, Pa., plans plant at Salt Lake City, Utah, to cost $2,000,000. Great Falls, Mont., plans installation of lighting system at municipal airport. American Beet Sugar Company, Denver, Colo., plans beet sugar mill at Winnipeg, Man., to cost about $1,000,000. Fort Morgan, Colo., plans extensions and improvements in municipal electric light and power plant, including additional equipment. Colorado Springs, Colo., plans ornamental lighting system. Arizona Power Company, Prescott, Ariz., plans construction of a transmission line from Prescott to Ashfork and Seligman, to cost $150,000; a power substation will be built at Prescott to cost $80,000.

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SOUTHWEST

—GENERAL BUSINESS HAS BEEN *keeping up near to normal in the stock sizes of apparatus, with central stations leading in the volume of purchases, while industrials are still buying cautiously.*

One of the power companies bought a lot of oil reservoirs for oil-filled cable joints amounting to $10,000, one contract was placed for a 400-hp. synchronous motor to cost $4,000, and orders amounting to about $7,500 were placed for oil circuit breakers, reclosing switching equipment and transformers for a large broadcasting station being erected.

CONSTRUCTION PROJECTS

Moberly, Mo., contemplates a municipal electric light and power plant to cost $150,000. Stilwell, Okla., plans extensions and improvements in municipal electric light and power plant to cost $30,000. Barnsdall Corporation, Barnsdall, Okla., plans pipe line for oil service to Milwaukee, Wis., and vicinity, with booster stations, etc., to cost $8,000,000. Texas Potash Company, Dallas, Tex., plans mining and refining plant at Midland, Tex., to cost over $1,000,000. Gulf States Utilities Company, Beaumont, Tex., plans transmission line to Dayton, Tex., about 50 miles.

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MIDDLE WEST

—GENERAL BUSINESS *in the Middle West section continues to show some improvement. Considerable spottiness is still evident, but conditions as a whole are improving. A somewhat general feeling of relief is apparent with the passing of the first two months of the year, and industry is looking forward to better business this month.*

The various utility compa ies are actively engaged with a certain amount of spring construction work, and one large utility company is scheduling the installation of 350,000 lb. of weatherproof wire during March. Some of the interesting orders placed this week include coal storage and reclaiming equipment to cost $95,000, one steam receiver and separator complete with appurtenances, and several construction orders aggregating $150,000.

CONSTRUCTION PROJECTS

Line Material Company, Milwaukee, Wis., will soon begin superstructure for an addition to cost $85,000. Superior, Wis., plans arc lamp street-lighting system. City Hospital, Dearborn, Mich., plans power plant to cost about $50,000. State Board of Administration, Lansing, Mich., plans power plant at state hospital, reported to cost over $250,000. Michigan Public Service Company, Ludington, Mich., plans extensions in Leland hydro-electric power plant to cost over $150,000. Portland, Mich., plans extensions and improvements in municipal power plant to cost $30,000. International Harvester Company, Chicago, Ill., plans factory branch and distributing plant at Grand Island, Neb., to cost $150,000. Walker Vehicle Company, Chicago, Ill., plans electric truck plant to cost $250,000. Riverside, Ill., plans ornamental lighting system. Oliver Farm Equipment Company, Chicago, Ill., plans factory branch and distributing plant at Great Falls, Mont., to cost $250,000. Ohio Edison Company, Dayton, Ohio, will build a power substation to cost $90,000. Lamourc.

N. D., plans ornamental lighting system. Fairmont, Minn., plans call for bids for extensions in municipal electric light and power plant to cost $40,000. Beatrice Power Company, Beatrice, Neb., plans transmission line at Barneston, Neb., and vicinity. Central Power Company, Grand Island, Neb., plans extensions and improvements in local power plant, reported to cost over $70,000. Mount Pleasant, Iowa, plans extensions and betterments in municipal power plant to cost $40,000.

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NEW ENGLAND

—STEADY DEMAND *for electrical equipment is reported by manufacturers in this district; industrial equipment sales are buoyant; central station equipment orders are increasing; merchandising shows a steady gain.*

Orders for industrial equipment are numerous, with small motor sales up and inquiries for turbo-generators, small switches and control apparatus quite active. Recently a number of large group orders for small motors for placement in textile mills, replacement in shoe and leather factories and for new plant development in this district were placed by one well-known manufacturer. At this time industrial equipment sales as compared with last year are ahead; motor sales amounting to over $20,000 were closed last week by one concern; interest in power generator units is active; small switch and control orders are reported in good volume.

Inquiries for pole line material are coming in fairly well; orders for several small lots of insulators were placed last week; outside control equipment is receiving attention. Projects being considered are estimated at over $250,000 for electrical equipment for new substations and additions in eastern Massachusetts. Among the special equipment lines active, are reported a steady demand for meters, special equipment for ice-making, street lighting and flood-lighting units. A manufacturer of electrically controlled street traffic signals records an encouraging interest in new installments in this district; railroad electric signal equipment is being considered in a new plan for reconstruction of a main line train control and regulation; new interior lighting units are being considered for new station effects. Merchandising shows a steady, encouraging trend. Industrial level in this district is higher.

CONSTRUCTION PROJECTS

Scott & Williams, Inc., Laconia, N. H., plan addition to textile machinery plant to cost about $100,000. Lee Electric Company, Lee, Mass., plans power substation to cost $100,000. State School, Belchertown, Mass., plans two industrial school buildings to cost $100,000. Texas Company, New York, plans oil storage and distributing plant at Hartford, Conn., to cost $200,000.

EASTERN

—THERE IS NO CHANGE *in situation in the electrical equipment market at New York. Both central stations and industrials continue buying at a good level and there is a healthy tone to the increasing volume of inquiries. Iron and steel mills, pulp and paper mills and ice-manufacturing plants are recording substantial commitments.*

Power company demand is still centered in substation apparatus and the bulk of current transactions are in that line. A central station on Long Island has contracted with a New York manufacturer for transformers and accessories to cost about $200,000 and for a quantity of switching apparatus costing $130,000. A metropolitan central station has purchased transformers from a state maker to cost $95,000, while a power company in central New York has placed a commitment for changing over 40-cycle generators and for transformer units totaling $120,000. A municipal power station in Nebraska has given an order for a 300-kw. turbo-generator, condenser and switchboard, with auxiliaries. A central New York manufacturer of engine-generator units has secured an order for an installation in a municipal power station in Minnesota.

Industrial account is growing active in connection with complete plant electrification programs and heavy investments are expected in this line in the early spring season. A Pennsylvania manufacturer has secured a contract for the electrification of a pulp and paper mill in Ohio, replacing present steam operation. A Pennsylvania steel mill has contracted with a Minnesota manufacturer for equipment for electrification of one of its units, the order including four 500-hp. and ten 300-hp. heavy-duty synchronous motors, with controls, etc.

Wire and cable account is becoming more active. Two metropolitan utility companies have been placing orders for cable with a New York manufacturer, one totaling $145,000 and the other $40,000.

CONSTRUCTION PROJECTS

Southern Mineral Products Corporation, operated by the Vanadium Corporation of America, Inc., New York, will build a mining, milling and chemical plant in Amherst County, Va., to cost $1,000,000. Lehigh Valley Terminal Warehouse, Inc., New York, contemplates terminal warehouses to cost $5,000,000. Western Electric Company, New York, has plans for another unit at plant at Baltimore, Md., to cost $1,500,000. Buffalo General Electric Company, Buffalo, N. Y., has filed plans for a power substation. Sun Oil Company, Philadelphia, Pa., plans oil storage and distributing plant at Cleveland, Ohio, to cost $2,000,000, and will build pipe line from Marcus Hook, Pa., to Cleveland and vicinity, to cost $5,000,000, with booster stations. Department of Public Safety, Philadelphia, Pa., will receive bids until March 20 for switchboard, underground and aerial cable, dynamotors and other electrical supplies for the Electrical Bureau. Philadelphia Electric Company, Philadelphia, Pa., plans power substation and extension in transmission lines at Morrisville, Pa., to cost $100,000. Department of Property and Supplies, Harrisburg, Pa., will receive bids until April 1 for electrical supplies. Randolph Mills, Inc., Philadelphia, Pa., plan textile mill to cost over $100,000. Titusville Iron Works, Inc., Titusville, Pa., has plans for an addition to cost $150,000. Rustless Iron Corporation of America, Inc., Baltimore, Md., plans an expansion and improvement program to cost over $1,000,000. The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until March 25 for two motor-generator sets for the Norfolk, Va., navy yard (Schedule 3012).

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SOUTHEAST

—A FAIRLY WELL-SUSTAINED *volume of orders and an increase in the number of inquiries is reported for the Southeast. There is a satisfactory amount of general business pending and the next week should witness some interesting orders.*

A power company in the Carolinas ordered power transformers amounting to $15,000, while a Georgia company, in anticipation of electric range sales activities, ordered distribution transformers to the extent of $13,550 during the past week. Some other central station orders were for house type meters amounting to $7,150, stranded and solid copper wire totaling $6,200, miscellaneous line materials amounting to $4,750 and creosoted pine poles costing $4,600. Electrical materials aggregating $40,000 were ordered in connection with an office building going up in Richmond, Va., and two hotels under the same management in Atlanta, Ga., ordered centralized radio systems totaling approximately $10,000. A coal and iron company in Alabama ordered a mine locomotive costing $15,000 and switching equipment amounting to $10,000 was ordered for a rayon plant addition in Tennessee.

CONSTRUCTION PROJECTS

Virginia Public Service Company, Charlottesville, Va., plans steam-operated electric power plant at Bremo, Va., with initial capacity of 30,000 kw. Norfolk & Western Railway Company, Roanoke, Va., plans forge and blacksmith shop at local repair works to cost $200,000. Kentucky-Tennessee Light & Power Company, Bowling Green, Ky., plans steam-operated electric power plant on Barren River, near city, to cost $1,000,000. Covington, Tenn., plans extensions and improvements in municipal electric light and power plant, reported to cost $40,000. Alabama Power Company, Birmingham, Ala., contemplates extensions in underground conduit system at Mobile, Ala., to cost $175,000.

New Equipment Available

Photo-electric Cell Unit with Amplifier

A PHOTO-ELECTRIC CELL with an amplifier is now sold as a unit by the Westinghouse Electric & Manufacturing Company. The photo-electric cell, often

called the "electric eye," is a light-sensitive device. When light falls upon it, voltage having been applied to the cathode, a current passes by means of electron emission from the cathode to the anode. This current is very small, but, when amplified, operates commercial relays.

The amplifier unit, shown in the illustration, consists of a die-cast aluminum box in which are mounted the necessary coupling devices. The top, which is a micarta panel, is provided with two four-prong bases for mounting the photo-electric cell and the amplifier tube. All of the wiring is concealed, connections being made to binding posts on the top panel. The unit is dust-proof and moisture-proof. The short connections in the unit make possible a very high speed response, between 0.0001 and 0.001 second.

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Meter Reading By Mail

A DEVICE BY WHICH the customer takes a record of his meter reading each month and mails it to the utility company has been marketed by the National Safety Devices Company, Waterloo, Iowa. It has been developed for attachment to the Westinghouse OB meter. The regular cover is replaced by a special one containing the mechanism for transfering the meter registration to the card. The dial pointers of the meter are replaced by pointers with knife edges on their faces and the transfer is accomplished by pressing the card against the pointers. The card carries the company address and a stamp and is mailed by the customer after he takes the meter reading. An identifying number is stamped simultaneously with the dial readings.

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AN ALL-METAL, ALL-WEATHER, WATERTIGHT PUSH BUTTON, superseding style No. 1786, has been announced by Edwards & Company, Inc., 140th and Exterior Streets, New York City. A pigskin diaphragm under the solid brass shell prevents rotting. Binding posts, phosphor bronze contact springs, tension springs, pure bakelite base and rubber gasket are all one unit. They are easily installed and the unit is designed for use where dampness or exposure of any kind threatens the life of a push button.

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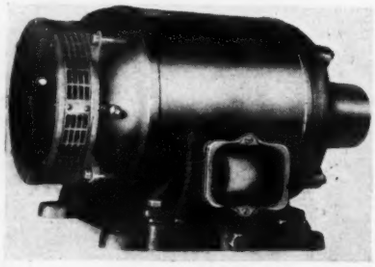
Fan-Cooled Inclosed Induction Motor

A NEW LINE of totally inclosed fan-cooled squirrel cage induction motors has been announced by the Century Electric Company, St. Louis, Mo. In most of the ratings they have the size advantages of a standard open-rated motor, plus the added advantage of full protection to the stator, rotor and other internal parts of the motor, all of which are completely isolated from the outside air. This effectively prevents the entrance of dust and dirt. The motor is completely inclosed, with no rubbing seals or air gaps.

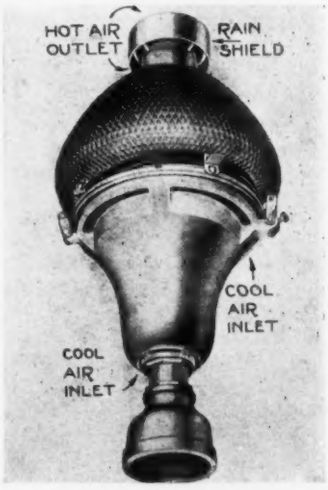
The fan blades are radial, which



makes the motor-cooling system equally effective regardless of the direction of rotation. Provisions are made to circulate the air within the motor shell and transfer the heat to the radiating surfaces, where it is carried away and dissipated by the cooling air.

Ventilated Substation Lighting Fixture

AN EXTERNALLY ADJUSTED substation lighting fixture with ventilating features has been announced by the Line Material Company, South Milwaukee, Wis. This unit has two cool air inlets and one hot air outlet. The cool air inlets are screened and arranged for



giving an even distribution of air through the glassware, one path being between the outer glassware and refractor and the other path being between refractor and lamp. The unit is made for use with lamps of 300 watts and above; for lamps less than 300 watts the standard inclosed fixture can be used without the special ventilating features.

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Air Switch Controls Refrigeration Plants

FOR USE WHERE automatic control is needed for the temperature of cold storage rooms, butcher boxes, florists' cabinets or similar cold air installations, the No. 149 air switch has been put on the market by the Time-O-Stat Controls Company, Elkhart, Ind. The instrument may be used as a limit control to prevent freeze-ups. The metal parts of this instrument are well protected against corrosion, and frost can neither damage the instrument nor interfere with its proper operation.

The No. 149 air switch is used for direct control of small refrigeration plants, as it can handle a ½-hp. motor load without a magnetic starter. For larger motor loads the No. 149 is used as the pilot for any of the ordinary starters. The air switch is also adapted for the operation of motor-controlled refrigerant valves, fans, blowers, etc.